The International Amateur Radio Union

Since 1925, the Federation of National Amateur Radio Societies
Representing the Interests of Two-Way Amateur Radio Communication

ETHICS AND OPERATING PROCEDURES FOR THE RADIO AMATEUR

Edition 3
(June 2010)

By John Devoldere, ON4UN
and Mark Demeuleneere, ON4WW
Proof reading and corrections by Bob Whelan, G3PJT

PowerPoint version:

A PowerPoint presentation version of this document is also available. Both documents can be downloaded in various languages from:

http://www.ham-operating-ethics.org

The PDF document is available in more than 25 languages.

Translations:

If you are willing to help us with translating into another language, please contact one of the authors (on4un(at)uba.be or on4ww(at)uba.be). Someone else may already be working on a translation.

Copyright:

Unless specified otherwise, the information contained in this document is created and authored by John Devoldere ON4UN and Mark Demeuleneere ON4WW (the "authors") and as such, is the property of the authors and protected by **copyright law**. Unless specified otherwise, permission is granted to view, copy, print and distribute the content of this information subject to the following conditions:

1. it is used for informational, non-commercial purposes only;
2. any copy or portion must include a copyright notice (©John Devoldere ON4UN and Mark Demeuleneere ON4WW);
3. no modifications or alterations are made to the information without the written consent of the authors.

Permission to use this information for purposes other than those described above, or to use the information in any other way, must be requested in writing to either one of the authors.

TABLE OF CONTENT

Click on the page number to go to that page

The Radio Amateur's Code *5*

I. INTRODUCTION *5*

I.1. WELCOME 5

I. 2. AMATEUR RADIO CODE OF CONDUCT 6

I. 2.1. Basic principles 6

I.2.2. The danger of conflicts 6

I.2.3. How to avoid conflicts 7

I.2.4. The moral authority 7

I.2.5. The code of conduct 7

I.2.6. This manual 7

II. GENERAL OPERATING *8*

II.1. HAM LANGUAGE 8

II.2. LISTEN 9

II.3. USE YOUR CALLSIGN CORRECTLY 9

II.4. ALWAYS BE A GENTLEMAN 9

II.5. ON THE REPEATER 10

II.6. HOW DO YOU MAKE A QSO? 10

II.7. WHAT DO YOU TALK ABOUT ON THE AMATEUR BANDS? 11

II.8. MAKING CONTACTS ON PHONE 11

II.8.1. How do you call CQ? 11

II.8.2. What does 'CQ DX' mean? 13

II.8.3. Calling a specific station 13

II.8.4. How do you make a QSO in phone? 13

II.8.5. Fast back and forth switching 15

II.8.6. How to make QSOs in a phone contest 16

II.8.7. The correct use of 'QRZ' 18

II.8.8. Check your transmission quality 19

II.9. THE ART OF TELEGRAPHY (CW, MORSE CODE) 19

II.9.1. The computer as your assistant 20

II.9.2. Calling CQ 21

II.9.3. Prosigns 22

II.9.4. Calling 'CQ DX' 22

II.9.5. Calling a specific station (a directive call) 22

II.9.6. Carry on and wrap up the CW QSO 23

II.9.7. Using 'BK' 25

II.9.8. Still faster 26

II.9.9. Using the prosign 'AS' (DIT DAH DIT DIT DIT) 26

II.9.10. Using 'KN' 26

II.9.11. How to answer a CQ 26

II.9.12. Someone sends an error in your call 26

II.9.13. Call a station that's finishing a QSO 27

II.9.14. Using the '=' sign or 'DAH DIT DIT DIT DAH' 27

II.9.15. Send good sounding code 27

II.9.16. I am a QRP station (= low power station) 28

II.9.17. The correct use of 'QRZ?' 28

II.9.18. The use of '?' instead of 'QRL?' 29

II.9.19. Sending 'DIT DIT' at the end of a QSO 29

II.9.20. Correcting a sending error 29
II.9.21. CW contests 29
II.9.22. Abbreviated numbers (cut numbers) used in contests 31
II.9.23. Zero beat 31
II.9.24. Where can one find slow speed CW stations (QRS)? 32
II.9.25. Do I have key clicks? 32
II.9.26. Too fast? 33
II.9.27. CW training software 33
II.9.28. Most used CW abbreviations 33
II.10. OTHER MODES 35
II.10.1. RTTY (Radioteletype) 36
II.10.2. PSK 31 (Phase Shift Keying) 39
II.10.3. SLOW SCAN TV (SSTV) 42
III. ADVANCED OPERATING 44
III.1. PILEUPS 44
III.1.1. Simplex pileup 44
III.1.2. Split (frequency) pileup 45
III.1.3. How to behave in a pileup? 45
III.1.4. Simplex pileup in phone 45
III.1.5. Simplex pileup in CW 47
III.1.6. Split frequency pileup in phone 48
III.1.7. Split (frequency) pileup in CW 49
III.2. TAIL ENDING 49
III.3. DXPEDITIONS 50
III.4. DX NETS 51
III.5. THE USE OF PARTIAL CALLS 52
III.6. DX CLUSTERS 53
III.6.1. Main Purpose 53
III.6.2. Who do you spot? 53
III.6.3. Which information is available, how to retrieve it 54
III.6.4. A spot appears: a new country for you. What now? 54
III.6.5. Things not to do on a DX Cluster 54
III.7. DX WINDOWS 56
III.7.1. DX windows on the HF bands 56
III.7.2. On VHF-UHF 57
III.8. SPECIFIC OPERATIONAL PROCEDURES FOR VHF AND HIGHER 57
III.9. CONFLICT SITUATIONS 58
III.10. COPS (FREQUENCY POLICE) 58
III.10.1. Types of 'cops' 58
III.10.2. What makes the cops appear? 59
III.10.3. The good sinners … 59
III.10.4. … and the bad sinners 59
III.10.5. Do you really want to be another cop? 59
III.10.6. How to behave in the middle of a cop parade? 60
III.11. TIPS FOR DX STATIONS AND DXPEDITION OPERATORS 60
Attachment 1: International Spelling and Phonetic Alphabet 65
THE AUTHORS: 67

The use of Commas and Full Stops: in this manual fractional parts are separated by a comma. Example: 3,51 MHz = 3.510 kHz, 1.000.000 = one million.

The Radio Amateur's Code

The Radio Amateur is

CONSIDERATE... He never knowingly operates in such a way as to lessen the pleasure of others.

LOYAL... He offers loyalty, encouragement and support to other amateurs, local clubs, the IARU Radio Society in his country, through which Amateur Radio in his country is represented nationally and internationally.

PROGRESSIVE... He keeps his station up to date. It is well-built and efficient. His ***operating practice*** is above reproach.

FRIENDLY... He operates slowly and patiently when requested; offers friendly advice and counsel to the beginner; kind assistance, cooperation and consideration for the interests of others. These are the marks of the amateur spirit.

BALANCED... Radio is a hobby, never interfering with duties owed to family, job, school or community.

PATRIOTIC... His station and skills are always ready for service to country and community.

-- adapted from the original Amateur's Code, written by Paul M. Segal, W9EEA, in 1928.

I. INTRODUCTION

I.1. WELCOME

Most radio amateurs or aspiring radio amateurs reading this manual are probably new to amateur radio. Up until recently, newcomers were thrown on the bands with very little, if any, help, without clear instructions or teaching on *how* to behave on the air. Can you imagine being released on the roads, in heavy traffic, without anyone having told you how to drive a car or how to behave on the road? This idea by itself seems frightening to most of us. Appearing on the ham bands without being prepared for this wonderful experience could be equally intimidating, to say the least. Don't panic though, everybody some day drove a car for the first time, and every ham was a new ham at first.

Welcome to the world of ham radio, welcome to our bands. This document will help you to better enjoy this wonderful hobby, right from the start. Don't forget, ham radio is a hobby, and a hobby by definition is something you enjoy!

The reader should not let himself be deterred by the many *rules* in this manual, thinking that these would lessen the pleasure and satisfaction of making radio

contacts. These rules are easy to understand and will rapidly become an automatic code of conduct for every ham *of good will*.
This manual is divided in three parts:

I. Introduction
Why this manual?

II. General Operating
This section applies to all radio amateurs, whatever kind of operating they do (rag chewing, DX chasing, contesting etc.).

III. Advanced Operating
This section covers subjects mainly linked to DXing: making QSOs in pile-ups, using the DX Cluster, DX nets, being the DX operator in a *rare* country, conflict situations etc.

I. 2. AMATEUR RADIO CODE OF CONDUCT

I. 2.1. Basic principles

Basic principles that should govern our **code of conduct** on the ham bands are:

- **Social feeling, feeling of brotherhood, brotherly spirit:** large numbers of us are all playing radio on the same airwaves (our playing field). We are never alone. All other hams are our colleagues, our brothers and sisters, our friends. Act accordingly. Always be considerate.
- **Tolerance**: not all hams necessarily share your opinions, and your opinions may also not be the *best* ones. Understand there are other people with different opinions on a given subject. Be tolerant. This world is not for you exclusively.
- **Politeness**: **never** use rude language or abusive words on the bands. Such behaviour says nothing about the person it is addressed to, but a lot about the person behaving that way. Keep yourself under control at all times.
- **Comprehension**: please understand that not everyone is as smart, as professional or as much an expert as you. If you want to do something about it, **act positively** (how can I help, how can I correct, how can I teach) rather than negatively (cursing, insulting etc.).

I.2.2. The danger of conflicts

Only one playing field, the ether: all hams want to play their game or want to exercise their sport, but it all has to be done on a single playing field: our amateur bands. Hundreds of thousands of players on a single playing field will sometimes lead to conflicts.

An example: All of a sudden you hear someone calling CQ or talking to someone else on *your* frequency (the frequency you've been using for a while). How is that possible? You were here for more than half an hour on a perfectly clear frequency! Yes, it IS possible; maybe that other station thinks as well that you have intruded on HIS frequency. Maybe the *skip* or propagation has changed.

I.2.3. How to avoid conflicts?

- By explaining to all players what the rules are, and by motivating them to apply these rules. Most of the actual conflicts are caused by **ignorance**: many hams don't know the rules well enough.
- In addition, many conflicts are handled in a poor way, once again through ignorance.
- This manual is intended to do something about this lack of knowledge, mainly aiming at avoiding conflicts of all sorts.

I.2.4. The moral authority

- In most countries the authorities do not care in detail how hams behave on their bands, providing that they operate according to the rules laid down by the authorities.
- The radio amateur community is said to be largely **self policing**, this means **self discipline** has to be the basis of our conduct. It does NOT mean though that the ham community has its **own police services**!

I.2.5. The code of conduct

What do we mean by ***code of conduct***? The code of conduct is a set of rules based on principles of **ethics**, as well as **operational considerations**.

- **Ethics:** determine our attitude, our general behaviour as radio amateurs. Ethics have to do with morals. Ethics are the principles of morals.

  Example: ethics tell us never willingly to interfere with transmissions from other stations. This is a moral rule. Not living by it is immoral, as is cheating in contests.
- **Practical rules**: to manage all aspects of our behaviour there is more than just ethics, there are also a number of rules based on **operational considerations** and on radio amateur **practice and habits**. To avoid conflicts we also need practical rules to guide our behaviour on the amateur bands, as making contacts on the bands is one of our principal activities. We are talking very **practical rules** and **guidelines**, governing aspects that are not related to ethics. Most operating procedures (how to make a QSO, how to call, where to operate, what QRZ means, how to use the Q code etc.) form part of it. Respect for the procedures guarantees optimal performance and effectiveness in our QSOs and will be a key in avoiding conflicts. These procedures came about as a result of daily practice over many years and as a result of ongoing technological developments.

I.2.6. This manual

- The manual is entirely dedicated to the code of conduct of radio amateurs. For the greatest part this code of conduct consists of operational procedures, topped off with the moral principles which are the foundation for our general behaviour as explained above.
- Knowledge of the **amateur code of conduct** is as important for hams as the knowledge of the national rules and regulations and the basics of electricity, electronics, antennas, propagation, safety etc.
- This manual aims to make all hams familiar with this code of conduct on the bands, whether they are old timers or newcomers or candidate hams.

- This has never been done so far in such great detail, and the detailed knowledge of this code of conduct has so far not been included in either the study or the exam material for candidate hams. This appears to be one of the reasons why, unfortunately, we hear so many shortcomings and infringements of this code of conduct on our bands.
- Teaching newcomers and testing their knowledge during the radio amateur exams will hopefully make it less necessary to correct situations on the air, and will make our bands a more attractive place for all of us where cursing, jamming and shouting will soon be only a bad memory.
- Hams make errors regarding these operating procedures mainly because they have never been taught how to behave correctly. They have hardly been trained on this subject. We should not blame them, we should train them!
- This manual covers operating procedures regarding the most used transmission modes (SSB, CW, RTTY and PSK).

II. GENERAL OPERATING

II.1. HAM LANGUAGE

- A ***ham*** is a radio amateur.
- As hams we address one another exclusively with their first name (or nickname), never with *mister*, *miss* nor *misses* or with a family name. This is also true for written communication between hams.
- The ham etiquette says we greet one another in our writings using '*73*' (not *best 73* nor *many 73*), and not *sincerely* or other similar formal expressions.
- If you used to be a CB operator, erase the CB language from your memory, and learn the amateur radio idioms (jargon, slang) instead. As a member of the amateur radio community you are expected to know the typical amateur radio expressions and idioms, which will help you to become fully accepted by the ham community.
- During your on-the-air contacts, use the **Q code** (attachment 2) **correctly**. Avoid overkill by using the Q code all the time in phone. You can also use standard expressions that everybody understands. Some Q codes have however become standard expressions even in phone, e.g.:

The QRG	the frequency
QRM	interference
QRN	interference from atmospherics (static crashes)
A QRP	a child
Going QRT	leave the air, stop transmitting
Being QRV	being ready, being available
QRX	just a moment, stand by
QRZ	who called me?
QSB	fading
QSL (card)	the card which confirms a contact
QSL	I confirm
A QSO	a contact
QSY	change frequency
QTH	the place where your station is located (city, village)

- As well as the small number of Q codes which are commonly used on phone, there are some other *short* expressions that stem from CW (see § II.9.28) and that have become commonplace on phone, such as 73, 88, OM (*old man*), YL (*young lady*), etc.
- Use the one and only **international spelling alphabet** (attachment 1) correctly. Avoid *fantasies* which may sound funny or amusing in your own language, but which won't make your correspondent understand what you are saying... Do not use different spelling words in one and the same sentence. Example: '*CQ from ON9UN, oscar november nine uniform november, ocean nancy nine united nations...*'
- The most widely used language in amateur radio is undoubtedly English. If you want to contact stations all over the world it is likely that a majority of your contacts will be made in English language. It goes without saying though that two hams, both speaking language different from English can of course converse in that language.
- Making contacts in Morse code (CW) is always possible without speaking a single word in the language of your QSO partner.
- It is clear that the hobby can be an excellent tool for learning and practicing languages. You will always find someone on the bands that will be happy in helping you with a new language.

II.2. LISTEN

- A good radio amateur starts by listening a lot.
- You can learn a lot by listening but be careful, not all you hear on the bands are *good examples*. You will certainly witness a lot of incorrect operational procedures.
- If you are active on the bands, be a **good example** on the air and apply the guidelines as explained in this document.

II.3. USE YOUR CALLSIGN CORRECTLY

- Instead of ***callsign*** or ***call letters***, hams usually employ the short form ***call***.
- Use only your **complete** call to identify yourself. Don't start your transmission by identifying yourself or your correspondent by your or his first name (e.g. saying: *hello Mike, this is Louis…*).
- Identify yourself with your FULL callsign, not just the suffix! It is illegal to just use the suffix.
- Identify yourself *frequently.*

II.4. ALWAYS BE A GENTLEMAN

- Never use abusive terms, **stay polite, courteous and gentle, under all circumstances.**
- George Bernard Shaw once wrote: *There is no accomplishment so easy to acquire as politeness and none more profitable*.

II.5. ON THE REPEATER

- Repeaters serve in the first place to extend the operating range of portable and mobile stations on VHF/UHF.
- Use simplex wherever possible. Using repeaters to make contacts between two fixed stations should be an exception.
- If you want to talk via the repeater while it is already in use, wait for a pause between transmissions to announce your call.
- Only use the term 'break' or even better 'break break break' in an emergency or life-threatening situation. Better is to say 'break break break with emergency traffic'.
- Stations using the repeater should pause until its carrier drops out or a beep appears, to avoid inadvertent *doubling* (simultaneous transmission) and to allow time for new stations to identify. Pausing usually also allows the timer to reset, avoiding a *time-out.*
- Do not monopolize the repeater. Repeaters are there not only for you and your friends. Be conscious that others may want to use the repeater as well; be obliging.
- Keep your contacts through a repeater short and *to the point*.
- Repeaters should not serve to inform the XYL that you are on your way home and that lunch can be served... Contacts through amateur radio concern primarily the technique of radio communications.
- Don't break into a contact unless you have something significant to add. Interrupting is no more polite on the air than it is in person.
- Interrupting a conversation without identification is not correct and in principle it constitutes illegal interference.
- If you frequently use a particular repeater consider supporting those that keep that repeater on the air.

II.6. HOW DO YOU MAKE A QSO?

- A **QSO** is a contact by radio between two or more hams.
- You can make a general call (**CQ**), you can answer someone's CQ or call someone who has just finished a contact with another station. More on this follows...
- Which call comes first in your conversation? Correct is: 'W1ZZZ from G3ZZZ' (you are G3ZZZ, and W1ZZZ is the person you address). So, first give the call of the person you speak to, followed by your own call.
- How often should you identify? In most countries the rule is: *at the beginning and at the end of each transmission, with a minimum of at least once every 5 minutes*. A series of short *overs* is usually considered to be single transmission. In a contest it is not strictly necessary, from the viewpoint of the rule maker, to identify at each QSO. This 5 minute rule has come about as a requirement from the monitoring stations to be able to easily identify stations. From an **operational** point of view however, the only good procedure is to identify **at each QSO** (see also framed text on page 62).
- A *pause* or a *blank*: when your correspondent switches the transmission over to you, it is a good habit to wait a second before starting your transmission, in

order to check whether someone may want to join you, or use the frequency.
- Short or long transmissions? Preferably make short rather than long transmissions, this makes it much easier for your correspondent if he wants to comment on something you said.

II.7. WHAT DO YOU TALK ABOUT ON THE AMATEUR BANDS?

The subjects of our communications should always be related to the amateur radio hobby. Ham radio is a hobby regarding the **technique of radio communications** *in the broad sense of the term*. We should not use amateur radio to pass along the shopping list for tonight's dinner...

Some subjects which are a **no no** in amateur radio conversations on the air are:
- religion;
- politics;
- business (you can talk about your profession, but you cannot advertise for your business);
- derogatory remarks directed at any group (ethnic, religious, racial, sexual etc.).
- bathroom humor: if you wouldn't tell the joke to your ten year old child, don't tell it on the radio;
- any subject that has no relation whatsoever with the ham radio hobby.

II.8. MAKING CONTACTS ON PHONE

II.8.1. How do you call CQ?

Sometimes before transmitting it is necessary to tune (adjust) the transmitter (or antenna tuner). Tuning should in the first instance be done on a dummy load. If necessary, fine tuning can be done on a clear frequency with reduced power, after having asked if the frequency is in use.
- What should you do first of all?
  - Check which band you want to use for the distance and the direction you want to cover. MUF charts are published on many websites, and can help in predicting HF propagation.
  - Check which portion of the band you should use for phone contacts. Always have a copy of the IARU Band Plan available on your operating desk.
  - Remember, SSB transmissions below 10 MHz are done on LSB, above 10 MHz on USB.
  - Also, when you transmit on USB on a given nominal (suppressed carrier) frequency, your transmission on SSB will spread at least 3 kHz above that frequency. On LSB it is the inverse, your signal will spread at least 3 kHz below the frequency indicated on your rig. This means: never transmit on LSB below 1.843 kHz (1.840 is the lower limit of the sideband section); never transmit on LSB below 3.603 kHz, or on USB never above 14.347 kHz, etc.
  - And then?
  - Now you are ready to start listening for a while on the band or frequency you intend to use...
  - If the frequency seems to be clear to you, ask if it is in use ('anyone using this frequency?' or 'is this frequency in use?'). Some operators ask 'is this

frequency clear?', but asking this way may lead to confusion. It does not mean that, if a frequency is 'clear' for one particular station, it really is a clear frequency. So, let's find out if other stations are already using the frequency by asking: 'anyone using this frequency?' or 'is this frequency in use?'.

- If you have already listened for a while on an apparently clear frequency, why do you in addition have to ask if the frequency is in use? Because one station, part of a QSO, who is located in the skip zone vs. your location, could be transmitting on the frequency. This means that you cannot hear him (and he won't hear you) because he is too far for propagation via ground wave and too close for propagation via ionospheric reflection. On the higher HF bands this usually means stations located a few hundred kilometres from you. If you ask if the frequency is in use, his correspondent may hear you and confirm. If you start transmitting without asking, chances are you will be causing QRM to at least one of the stations on frequency.
- If the frequency is occupied, the user will most likely answer 'yes' or more politely 'yes, thank you for asking'. In this case you have to look for another frequency to call CQ.
- And if nobody replies?
- Ask again: 'is this frequency in use?'
- And if still no one replies?

- Call CQ: 'CQ from G3ZZZ, G3ZZZ calling CQ, golf three zulu zulu zulu calling CQ and listening'. At the end you may say '...calling CQ and standing by', instead of '…and listening'. One could also say: '...and standing by for any call'.
- Always speak clearly and distinctly, and pronounce all words correctly.
- Give your call 2 to maximum 4 times during a CQ.
- Use the international spelling alphabet (for spelling out your callsign) once or twice during your CQ.
- It's better to use several consecutive short CQs rather than one long CQ.
- Do not end a CQ with 'over', as in this example: 'CQ CQ G3ZZZ golf three zulu zulu zulu calling CQ and standing by. Over'. 'Over' means 'over to you'. At the end of a CQ you cannot turn it over to anyone as you are not yet in contact!
- Never end a CQ by saying 'QRZ'. 'QRZ' means 'who was calling me?'. It is obvious that nobody WAS calling you before you started your CQ! A totally wrong way of ending a CQ is as follows: 'CQ 20 CQ 20 from G3ZZZ golf three zulu zulu zulu calling CQ, G3ZZZ calling CQ 20, QRZ', or '…calling CQ 20 and standing by. QRZ'.
- If you call CQ and want to listen on another frequency than the one you transmit on, end **each CQ** by indicating your listening frequency, e.g. '...listening 5 to 10 up' or also '...listening on 14295', etc. Just saying 'listening up' or 'up' is not sufficient, as you don't say where you are listening. This method of making QSOs is called *split frequency* working.
- If you intend to work *split frequency*, always check if the frequency you plan to use for listening is free, as well as the frequency on which you will call CQ.
- Saying 'CQ from Victor Romeo two Oscar Portable' is not very clear. Either VR2OP calls CQ using an incorrect spelling phonetic, or VR2O/p calls CQ and omits to add the expression 'stroke' while calling CQ. This can lead to a lot of confusion. Always use the term 'stroke' when you are portable, mobile etc.

II.8.2. What does 'CQ DX' mean?

- If you want to contact *long distance* stations, call 'CQ DX'.
- What is **DX**?
- On HF: stations outside your own continent, or of a country with very limited amateur radio activity (e.g. Mount Athos, Order of Malta etc. in Europe).
- On VHF-UHF: stations located at more than approx. 300 km.
- During a CQ you can insist that you only want to work DX stations, as follows: 'CQ DX, outside Europe, this is…'.
- Always be obliging; maybe the local station calling you after your CQ DX is a newcomer, and maybe you are a *new country* for him. Why not just give him a quick QSO?

II.8.3. Calling a specific station

- Let us assume that you want to call DL1ZZZ with whom you have a *sked* (*schedule, rendez-vous*). Here's how you do this: 'DL1ZZZ, DL1ZZZ this is G3ZZZ calling on sked and listening for you*'.*
- If, despite your directive call someone else calls you, remain polite. Give him a quick report and say 'sorry, I have a sked with DL1ZZZ…'.

II.8.4. How do you make a QSO in phone?

- Assume you get a reply to your CQ call, e.g.: 'G3ZZZ from W1ZZZ, whiskey one zulu zulu zulu is calling you and listening' or 'G3ZZZ from W1ZZZ, whiskey one zulu zulu zulu **over**'.
- We have explained why you cannot end your CQ with 'over' (§ II.8.1). When someone answers your CQ, he wants to turn it over to you (get an answer from you), which means that he can end his call with 'over' (meaning 'over to you').
- If a station answers your CQ, the first thing you need to do is to acknowledge his call, after which you can right away tell him how you are receiving his transmission, give him your name and *QTH* (location): 'W1ZZZ from G3ZZZ (be careful, keep the right sequence!), thanks for the call, I am receiving you very well, readability 5 and strength 8 (usually the indication on the S-meter on your receiver). My QTH is London and my name is John (not '*my personal name'* nor '*my personal'* nor '*my first personal'*; there are no such things as *personal* or *impersonal* names). 'How do you copy me? W1ZZZ from G3ZZZ. Over'.
- If you call a station that has called CQ (or QRZ), call that station by giving his call not more than once. In most cases it's better not to give it at all; the operator knows his own call. In a contest (§ II.8.6) you never give the callsign of the station you are calling.
- In phone we exchange an RS report, a report of Readability and of signal Strength.
- We have already said not to overly use the Q code in phone contacts, but if you use it, do it correctly. *QRK* means *Readability of the signal*, which is the same as R in the RS report. QSA means *Signal Strength* as the S from the RS report.

  - One thing is different however, the range of the S in the RS report goes from 1 to 9, in the QSA code it goes from 1 to 5 only.
  - So, don't say 'you're QSA 5 and QRK 9' (as we sometimes hear), but if you want to use Q code, say: 'you are QRK 5 and QSA 5'. Of course it is much

simpler to say 'you're 5 and 9'. On CW the use of QRK and QSA is almost non-existent. In CW only the RST report is used instead (§ II.9.6).

READABILITY		SIGNAL STRENGTH	
R1	Unreadable	**S1**	Faint signals, barely perceptible
R2	Barely readable	**S2**	Very weak signals
R3	Readable with difficulty	**S3**	Weak Signals
R4	Readable with no difficulty	**S4**	Fair signals
R5	Perfectly readable	**S5**	Fairly good signals
		S6	Good signals
		S7	Fairly strong signals
		S8	Strong signals
		S9	Very strong signals

- Using the word 'over' at the end of your *over* is recommended but not really a must. A QSO consists of a number of transmissions or *overs*. 'Over' stands for 'over to you'.
- If signals are not very strong and if the readability is not perfect, you can spell out your name etc. Example: 'My name is John, spelled juliett, oscar, hotel, november …' Do NOT say '…juliett juliett, oscar oscar, hotel hotel, november november'. This is **not** the way you spell the name **John**.
- In most short, so-called rubber stamp QSOs, you will describe your station and antenna and often other data such as weather info (related to propagation especially on VHF and higher) can be exchanged. As a rule it is the station that was first on the frequency (e.g. the station who called CQ) that should take the initiative to bring up subjects of conversation. Maybe he just wants a shorts *hello and good by* contact.
- Use the correct terminology when describing your station. Do not say 'I am working with 5 Whiskey…'. This certainly is not standard ham language. Simply say: "I am running 5 Watts".
- Even during a stereotype QSO we often see technical discussions being developed and results of experimentation being exchanged, just as we would do during *eyeball conversations*. Worth mentioning as well is that many friendships have been forged as a result of radio contacts between hams. The hobby is a real bridge builder between communities, cultures and civilizations!
- If you wish to **QSL** (exchange cards), mention it: 'Please QSL. I will send my card to you via the QSL bureau and would appreciate your card as well'. A QSL is a postcard sized report confirming a QSO you made.
- QSL cards may be mailed directly to the other station or sent via a QSL bureau. Just about all Radio Societies, members of IARU, exchange QSL cards for their members. Some stations only QSL via a QSL manager who handles the mail for him/her. Details of those can be found on various websites.
- Ethics require that hams should be willing to exchange QSL cards without asking money for it other than to cover return postage charges if a direct exchange is requested.
- To wrap up a QSO: '…W1ZZZ, this is G3ZZZ signing with you and listening for any other calls', or if you intend to go off the air '…and closing down the

station'.

- You may add the word 'out' at the end of your last transmission, indicating you are closing down, but it is seldom done. Do NOT say 'over and out', because 'over' means you switch over to your correspondent, and in this case there is no longer a correspondent!

Typical SSB QSO for the beginner:

Is this frequency in use? This is W1ZZZ

Is this frequency in use? This is W1ZZZ

CQ CQ CQ from W1ZZZ whiskey one zulu zulu zulu calling CQ and listening

W1ZZZ from ON6YYY oscar november six yankee yankee yankee calling and standing by

ON6YYY from W1ZZZ, good evening, thanks for your call, you are 59. My name is Robert, I spell Romeo Oscar Bravo Echo Romeo Tango and my QTH is Boston. How copy? ON6YYY from W1ZZZ. Over.

W1ZZZ from ON6YYY, good evening Robert, I copy you very well, 57, readability 5 and strength 7. My name is John, Juliette Oscar Hotel November, and my QTH is near Ghent . Back to you Robert. W1ZZZ from ON6YYY. Over.

ON6YYY from W1ZZZ, thanks for the report John. My working conditions are a 100 Watt transceiver with a dipole 10 meter high. I would like to exchange QSL cards with you, and will send you my card via the bureau. Many thanks for this contact, 73 and see you soon again, I hope. ON6YYY from W1ZZZ.

W1ZZZ from ON6YYY, all copied 100%, on this side I am using 10 Watt with an inverted-V antenna with the apex at 8 meters. I will also send you my QSL card via the bureau, Robert. 73 and hope to meet you again soon. W1ZZZ this is ON6YYY clear with you.

73 John and see you soon from W1ZZZ now clear (…and listening for any stations calling)

II.8.5. Fast back and forth switching

- If you are involved in a quick back and forth conversation, involving short transmissions, you do not need to identify at each *over*. One must identify at least once every 5 minutes (in some countries 10 minutes) as well as at the beginning and at the end of your *transmissions* (can be a series of QSOs).
- You can also turn it over to your correspondent by simply saying 'over', meaning you turned the microphone over to him/her to start his transmission. Even faster is to just stop talking and pause. If the pause exceeds 1 or 2 seconds your correspondent will simply start transmitting.

II.8.6. How to make QSOs in a phone contest?

- ***Contest*** is the name for a radio communication competition between radio amateurs.
- **What is Contesting**? It is the competitive side of Ham Radio.
- **Why contesting**? Contests are competitions in which a radio amateur can measure the competitive performance of his station and antennas, as well as his performance as an operator. As the English say: *the proof of the pudding is in the eating*.
- **How to become a good contester**? Most champion contesters started working contests on a local level. Like in all sports you can only become a champion through lots of exercising.
- **Are there many contests**? There are contests every weekend, totalling well over 200 contests every year. About 20 have the status of important international contests (ham radio's equivalent to Formula 1 racing).
- **Contest calendar**: see various internet sites such as http://ng3k.com/Contest/.
- In most contests the competitors should make as many contacts as possible with e.g. as many as possible different countries (or States, radio zones etc.): these are the so-called **multipliers** which will be used together with the number of QSOs to calculate your score. Big international contests run for 24 or 48 hours, some small local contests only last 3 or 4 hours. Plenty of choice!
- Contests are organized on most bands, HF through SHF.
- There are no contests on the so-called WARC bands: 10 MHz, 18 MHz and 24 MHz. This is because these bands are quite narrow. Contesting would render these bands too crowded to be enjoyable for other users.
- In a contest a valid QSO is made when a callsign, a signal report and often a serial number (or radio zone, locator, age etc.) are exchanged.
- Contest operating is all about **speed**, **efficiency** and **accuracy**. One is expected to say only and exactly what's strictly required. This is not the time for showing you are well educated, and 'thank you', '73', 'see you later' etc. are just not said in a contest. It's all a waste of time.
- If you are new to contesting, it is advisable to first visit a contester during a contest. You can also make your first steps in contesting by participating e.g. in a field day with your local radio club.
- If you decide to try your first contest, start by listening for half an hour (longer is better) to see how the routine contesters go about it. Identify the right procedures to make fast contacts. Be aware that not all that you will hear are good examples. A few examples of common errors are discussed further on.
- An example of a fully efficient contest CQ is: 'G3ZZZ golf three zulu zulu zulu contest'. Always give your call twice, once phonetically, unless you're in a big pileup, in which case you give your call just once and forget about spelling it out very time. Why is the word *contest* the last word in your contest CQ? Because by doing so, someone who happens to tune across your frequency at the end of the CQ, knows there is someone calling CQ contest on that frequency. Even the word *CQ* is left out as it is ballast and contains no added information. Assume you give your call at the end (instead of the word *contest*): in this case the station tuning across the frequency copied your call (he checks in his log whether he needs you or not; assume he does), but he

does not know if you are just working a station or calling CQ. In this case he will have to wait one round to find out, which is a waste of time. That's why you should use the word 'contest' at the end of your (contest) CQ.

- The caller should call you by giving his call just once. Example: 'golf three x-ray x-ray x-ray'. If you do not reply to him within a second, he will give his call again (just once).
- If you copied his call, you will immediately reply as follows: 'G3XXX 59001' or even faster 'G3XXX 591' (check if the contest rules accept the short number where you leave out the leading zeros). In most contests you will have to exchange a RS report and a serial number (in the above example 001 or simply 1). That is the complete exchange; all the rest is ballast.
- If you (G3ZZZ) copied only a partial call (e.g. ON4X..), go back to him as follows: 'ON4X 59001'. Do not send 'QRZ ON4X' or anything like that. You have identified the station you want to work, so go ahead with his partial call. Any other procedure will make you lose time. Being a good operator, ON4XXX will return to you with 'ON4XXX x-ray x-ray x-ray, you are 59012'.
- Never say 'ON4XXX please copy 59001', nor 'ON4XXX copy 59001' which is equally bad. The 'please copy' or 'copy' contains no additional information.
- Being an experienced contester, ON4XXX will come back as follows: '59012'. If he had not copied the report he would have said 'report again' or 'please again'.
- This means neither 'thanks 59012' nor 'QSL 59012' nor 'roger 59012', things that are often being said by less experienced contesters.
- All that's left to be done is to round off the contact as follows: 'thanks G3ZZZ contest' (*thanks* is shorter and faster than *thank you*). By saying this you do 3 distinct things: you end your contact (*thanks*), you identify yourself for stations wanting to call you (*G3ZZZ*), and you call CQ (*contest*). Utmost efficient!
- Do not end with 'QSL QRZ'. Why? 'QSL QRZ' does not tell anything about your identity (call). And you want all passers-by that stumble across your frequency at the end of your QSO, to know who you are and that you are calling CQ-contest. Therefore always end with 'thanks G3ZZZ contest' (or 'QSL G3ZZZ contest') or if you are very much in a hurry 'G3ZZZ contest' (this may however lead to confusion and sounds less friendly). 'QSL' means: *I confirm.* Don't say 'QRZ' because QRZ means 'who called me', unless there were more stations calling you in the first place when you picked out G3XXX.
- There are of course some possible variations to this scheme, but essential to this all is: speed, efficiency, accuracy and the correct use of the Q code.
- Most contest operators use a computer contest logging program. Make sure you have thoroughly tested and tried out the program before using it in real life.
- Apart from calling CQ in a contest to make QSOs you could search the bands looking for so-called *multipliers* or stations you have not worked yet. This is called *search and pounce*. How do you go about this? Make sure you are exactly zero beat with the station you want to work (watch the RIT!). Just give your call **once**. Don't call as follows: 'DL1ZZZ from G3ZZZ'; DL1ZZZ certainly knows his call, and knows you are calling **him** because you call on **his** frequency!
- So, give your call one time. If he does not return to you within 1 second, call again (1 time) etc.

Example of a contest QSO on phone:

whiskey one zulu zulu zulu contest (CQ contest by W1ZZZ)

oscar november six zulu zulu zulu (ON6ZZZ answers)

ON6ZZZ five nine zero zero one (W1ZZZ gives a report to ON6ZZZ)

five nine zero zero three (ON6ZZZ gives his report to W1ZZZ)

thanks W1ZZZ contest (W1ZZZ finishes the contact, identifies and calls CQ contest)

- During some of the larger international contests (CQWW, WPX, ARRL DX, CQ-160m contest –all of these in phone as well as in CW-), contest operators not always fully live by the IARU Band Plan. This happens almost exclusively on 160m and 40m, because of the restricted space on those bands. It is nice however to see that during these contests many thousand of hams intensively occupy our bands, which is very positive in view of our required band occupation (use them or lose them). The temporary nuisances caused by this exceptional situation, should best be approached with a positive attitude.

II.8.7. The correct use of 'QRZ'

- 'QRZ' means 'who called me?', nothing more, nothing less.
- The most classical use of 'QRZ' is after a CQ, when you were unable to copy the call(s) of the station(s) that called you. In a way it means 'I am sorry, I heard you calling me, but could not get your call. Please call again'.
- It does not mean 'who's there?' neither does it mean 'who's on the frequency?' and even less 'please call me'.
- If someone comes on an apparently clear frequency and wants to check whether or not it is in use, he should not use 'QRZ?' to do that! Just ask 'is this frequency in use?'.
- If you have been listening to a particular station which has not identified for some time and you would like to know his call, you can ask 'your call please' or 'please identify'. Strictly spoken you would need to add your callsign, because you need to identify yourself.
- 'QRZ' certainly does NOT mean 'call me please'. We more and more frequently hear CQ calls ending in the word 'QRZ'. This makes no sense. How can someone already have been calling if you just finished a CQ?
- Another incorrect use of 'QRZ': I am calling CQ in a contest. A station tunes across my frequency and just catches the tail end of my CQ, but missed my callsign. We often hear stations in such circumstances say 'QRZ'. Totally wrong. Nobody has called this station. All he has to do is to wait for my next CQ to find out my call! The same remark applies to CW of course.
- Other similar rather funny but incorrect expressions are: 'QRZ is this frequency in use?' or 'QRZ the frequency' (should be 'is this frequency in use?').
- One more rather widespread incorrect use of 'QRZ': 'CQ DX CQ this is UR5ZZZ QRZ DX'. Just say ''CQ DX CQ this is UR5ZZZ calling CQ DX and listening'.
- Another incorrect use of QRZ: 'give me your QRZ' which is supposed to mean

'give me your call'. It is remarkable that in most of the above erroneous uses of "QRZ" there is a link to the idea of "callsign". But please, do use 'QRZ' in the one and only meaning it has: 'who called me'

- During pileups (see § III.1) we will often hear the DX station saying 'QRZ', not because in the first place he previously missed a call but to tell the pileup he is listening again. This use of 'QRZ' is not quite correct.

Example:

CQ ZK1DX	ZK1DX calls CQ
ON4YYY you're 59	ON4YYY calls ZK1DX who replies with a report
QSL **QRZ** ZK1DX	ZK1DX confirms the report ('QSL') and adds 'QRZ', which in this case means *I am listening again for the stations calling me* rather than *who called me?* which is the real meaning of 'QRZ'. Although you could argue that he heard other stations before and hence can call 'QRZ', the use of 'QRZ' followed by 'ZK1DX' is certainly not the most efficient procedure.

What we hear even more and which is completely wrong:

...

QSL **QRZ**	in this case ZK1DX does not identify at all. The pileup wants to know who the DX station is.

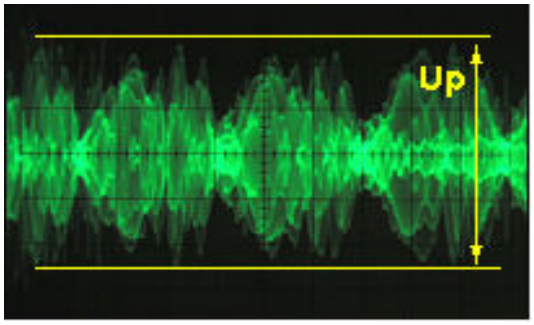
The correct and most efficient procedure is as follows:

...

QSL ZK1DX	ZK1DX confirms the report he received by saying 'QSL'. This is followed by his call, which is the sign for the pileup to call him.

II.8.8. Check your transmission quality

- Have you properly adjusted your transmitter?
- Is the microphone gain not set too high?
- Is the speech processing level not too high? The background noise level should be at least 25 dB down from your voice peak level. This means that when you don't speak the output level of the transmitter must be at least approximately 300 times lower than the peak power when you speak.



- Ask a local ham to check your transmission for *splatter*.
- Having an oscilloscope in line with the output signal so you can monitor for flat topping is the best continuous monitoring system.

II.9. THE ART OF TELEGRAPHY (CW, MORSE CODE)

- Morse code is a code for transmitting text. The code is made up by sequences of short and long audio tones. A short tone burst is called a **DIT**, the longer one a ***DAH***. The *DAHs* are 3 times as long as the *DITs*. These are frequently but

incorrectly called *DOTS* and *DASHES*, which make us think of something visual rather than sounds.

- Morse code is **not** a series of written *DOTS* and *DASHES*, although originally, in the 19th century, Morse code was scribed as *DOTS* and *DASHES* on a moving paper strip. Telegraph operators soon found out it was easier to copy the text by listening to the buzz of the scriber machine than trying to read it off the paper strips. So the letter '**R**' is **not** *SHORT LONG SHORT* nor *DOT DASH DOT*, nor **. - .** but ***DIT DAH DIT***.
- In some languages the letter '**R**' will be written as **DIT DAH DIT**, in others as **DI DAH DIT**. What we are trying to make clear is that there are only two sounds, the short sound (**DIT** or **DI**) and the long sound (**DAH**). Representing two sounds by three words may be confusing; therefore we use only **DIT** and **DAH** in this document.
- CW makes extensive use of *Q codes*, *abbreviations* and *prosigns*. These are all shortcuts to make communicating faster and more efficient.
- Hams normally use the word ***CW*** for telegraphy. The term *CW* stems from *Continuous Wave* although CW is far from being a *continuous wave*, but rather a wave which is constantly interrupted at the rhythm of the Morse code. Hams use the terms *Morse* and *CW* interchangeably – they mean the same thing.
- The -6dB bandwidth of a properly shaped CW signal is approximately 4 times the sending speed in WPM (Words Per Minute). Example: CW at 25 WPM takes 100 Hz (at -6dB). The spectrum required to transmit one SSB (voice) signal (2,7 kHz) can hold more than a dozen CW signals!
- The intrinsic narrow bandwidth of CW results in a much better Signal-to-Noise ratio under marginal conditions as compared to wide band signals such as SSB (a wider bandwidth contains more noise power than a narrower bandwidth). This is why DX contacts under marginal conditions (e.g. working stations in other continents on 160m and working EME) are most frequently done in CW.
- What's the minimum receiving speed you need to master to be able to regularly make QSOs in Morse code?
  - 5 WPM can get you a starter's certificate, but you will not be able to make many contacts except on the special *QRS* (*QRS* means: reduce your sending speed) frequencies. These *QRS* frequencies can be found in the IARU Band Plan.
  - 12 WPM is a minimum, but most experienced CW operators make their QSOs at 20 to 30 WPM and even higher speeds.
- There is no secret recipe to master the **Art** of CW: training, training, training, just as in any sport.
- CW is a unique language, a language which is mastered in all countries of the world!

II.9.1. The computer as your assistant?

- You will **not** learn CW by using a computer program that helps you to decode

CW.

- It is acceptable though to send CW from a computer (pre-programmed short messages). This is commonly done in contests by the logging program.
- As a newcomer you may want to use a CW decoding program to **assist** you in order to be able to verify that a text was correctly decoded. However, if you really want to learn the code, you will need to decode the same CW text yourself using your ears and brain.
- CW decoding programs perform very poorly under anything but perfect conditions; our ears and brains are far superior. This is mainly because Morse code was not developed to be automatically sent nor received, as is the case with many modern digital codes (RTTY, PSK etc.).
- A large majority of **CW operators** use an electronic keyer (with a paddle) instead of a hand key to generate Morse code. It is much easier to send *good* Morse code using an electronic keyer than with a hand key.

II.9.2. Calling CQ

- What should you do first of all?
  - Decide which band you will use. On which band is there good propagation for the path you want to cover? The monthly MUF charts, published in magazines and on many ham websites can be very helpful in this respect.
  - Check which band portions are reserved for CW work. On most bands this is at the bottom end of the bands. Consult the **IARU Band Plan** on the IARU website.
  - Listen for a while on the frequency you would like to use to find out whether it is clear or not.
  - And then?
  - If the frequency seems clear, ask if the frequency is in use. Send 'QRL?' at least twice, with a few seconds in between. Sending '?' only is not the proper procedure. The question mark just says 'I asked a question'; the problem is that you did not ask anything.
  - 'QRL?' (with the question mark) means 'is this frequency in use?'.
  - Do not send 'QRL? K' as we sometimes hear. It means 'is the frequency in use? Over to you'. To whom? Just 'QRL?' is correct.
  - If the frequency is in use, someone will answer 'R' (roger), 'Y' (yes), or 'R QSY', or 'QRL', 'C' (I confirm) etc.
  - 'QRL' (without question mark) means: the frequency **is** in use.
    In such a case you will have to look for another frequency to use.
- And if a clear frequency was found?
- Call CQ. How?
- Send CQ at the speed at which you would like to be answered. Never send faster than you can copy.
- 'CQ CQ G3ZZZ G3ZZZ G3ZZZ AR'.
- 'AR' means 'end of message' or 'I am through with this transmission', while 'K' means 'over to you' etc. This means you should always terminate your CQ with 'AR' and never with 'K', because there is nobody there yet whom you can turn it over to.
- Do **not** end your CQ with 'AR K': it means 'end of message, over to you'. There is nobody to turn it over to yet. End your CQ with 'AR'. It is true that we often

hear 'AR K' on the band, but it is not a proper procedure!

- The use of 'PSE' at the end of a CQ (e.g. 'CQ CQ de… PSE K') may seem to be very polite, but is not necessary. It has no added value. In addition, the use of the 'K' is incorrect. Simply use 'AR' at the end of your CQ.
- Send your call 2 to 4 times, certainly not more!
- Don't send an endless series of CQs, with your call just once at the end. Thinking that a long CQ will increase the chances of getting a response is wrong. It actually has the opposite effect. A station that may be interested in calling you first wants to know your call, and certainly is not interested in listening to an almost endless series of CQ CQ CQ …
- It's much better to send a number of short CQs ('CQ CQ de F9ZZZ F9ZZZ AR') than one long spun CQ ('CQ CQ CQ ... -15 times- de F9ZZZ CQ CQ CQ ... -15 more times- de F9ZZZ AR').
- If you call CQ and want to work *split* (listening on another frequency than you transmit on), specify your listening frequency **at each CQ**. Example: end your CQ with 'UP 5/10...' or 'UP 5...' or 'QSX 1822...' (which means that you will listen on 1.822 kHz). 'QSX' means 'I listen on ...'.

II.9.3. Prosigns

- **Prosigns** (short for *procedural signs*) are symbols formed by combining two characters into one *without the inter-character space*.
- 'AR', used to end a transmission, is a *prosign*.
- Other commonly used prosigns are:
  - 'AS' (see § II.9.9)
  - 'CL' (see § II.9.6)
  - 'SK' (see § II.9.6)
  - 'HH' (see § II.9.20)
- 'BK' (see § II.9.7) and 'KN' (see § II.9.10) are **not** prosigns, as the two letters of these codes are sent with a space in between.

II.9.4. Calling 'CQ DX'

- Just send 'CQ DX' instead of 'CQ'. If you want to work DX from a specific region, call e.g. 'CQ **JA** CQ **JA** I1ZZZ I1ZZZ **JA** AR' (a call for stations from Japan), or 'CQ **NA** CQ **NA**...' (a call for stations from North America) etc. You can also make your CQ DX call more explicit by adding that you do not want to contact European stations: 'CQ DX CQ DX I1ZZZ I1ZZZ DX **NO EU** AR', but this sounds a little aggressive.
- You can also specify a continent: NA = North America, SA = South America, AF = Africa, AS = Asia, EU = Europe, OC = Oceania.
- Even if a station from your own continent calls you, always remain courteous. Maybe he is a newcomer. Give him a quick contact and log him. You may actually be a new country for him!

II.9.5. Calling a specific station (a directive call)

- Let us assume that you want to call DL0ZZZ, with whom you have a *sked* (*schedule*, *rendez-vous*). Here's how you do this: 'DL0ZZZ DL0ZZZ SKED DE G3ZZZ KN'. Note the 'KN' at the end, which means you do not want other stations to call you.

- If, despite your directive call someone else calls you, give him a quick report and send 'SRI HVE SKED WID DL0ZZZ 73…'.

II.9.6. Carry on and wrap up the CW QSO

- Assume W1ZZZ is answering your CQ: 'G3ZZZ DE W1ZZZ W1ZZZ **AR**', or 'G3ZZZ DE W1ZZZ W1ZZZ **K**' or even 'W1ZZZ W1ZZZ **K**' or 'W1ZZZ W1ZZZ **AR**'.
- While replying to a CQ, do not send the call of the station you are calling more than once, better still is not to send it at all (you can trust the operator knows his own call…).
- Should the calling station end its call with 'AR' or 'K'? **Both are equally acceptable**. 'AR' means 'end of message' while 'K' means 'over to you'. The latter sounds a little more optimistic, as maybe the station you call will return for another station…
- There is however a good reason to use 'AR' rather than 'K'. 'AR' is a prosign (see § II.9.3) which means that the letters A and R are sent without any space between them. If one sends 'K' instead of 'AR' and if the letter 'K' is sent somewhat close to the callsign, the letter 'K' may be considered as being the last letter of the call. It happens all the time. With 'AR' this is quite impossible as 'AR' is not a letter. Often no closing code (neither AR nor K) is used, which reduces the risk of making errors.
- Assume you want to reply to W1ZZZ who called you. You can do that as follows: 'W1ZZZ DE G3ZZZ GE (good evening) TKS (thanks) FER (for) UR (your) CALL UR RST 589 589 NAME BOB BOB QTH LEEDS LEEDS HW CPY (how copy) W1ZZZ DE G3ZZZ K'. This is the time to use 'K' at the end of your transmission. 'K' means *over to you*, and now the *you* is W1ZZZ.
- Do not end your *over* with 'AR K': it means 'end of message, over to you'. It is clear that when you turn it over you have finished your message, no need to say so. End your transmissions (*overs*) during a QSO with 'K' (or 'KN' when necessary, see § II.9.10). True, we hear 'AR K' frequently, but it is incorrect.
- The reason for the improper uses of either 'AR', 'K', 'KN', 'AR K', or 'AR KN', is that many operators do not really know what each of these prosigns exactly mean. Let's use them properly!
- We explained that it is not necessary to use the term 'PSE' (*please*) to end a CQ; do not use it either at the end of your *over*. So no 'PSE K' or 'PSE KN'. Let's keep it simple, and leave out the 'PSE', please…
- On the VHF bands (and higher) it is customary to exchange the QTH-locator. This is a code indicating the geographic location of your station (example: JM12ab).
- The **RST report**: R and S stand for Readability (1 to 5) and signal Strength (1 to 9) as used for phone signals (see § II.8.4). The T (1 to 9) in the signal report stands for Tone. It indicates the pureness of the sound of the CW signal, which should sound like a pure sine wave signal without any distortion.
- These original tone ratings attributed to the different T values stem from the early days of amateur radio where often a pure CW tone was an exception rather than the rule. The above table lists the more modern CW tone ratings as published in 1995 (source: W4NRL).

T 1	60 Hz (or 50 Hz) AC or less, very rough and broad
T 2	Very rough AC, very harsh
T 3	Rough AC note, rectified but not filtered
T 4	Rough note, some trace of filtering
T 5	Filtered rectified AC, but strongly ripple-modulated
T 6	Filtered tone, definite trace of ripple modulation
T 7	Near pure tone, trace of ripple modulation
T 8	Near perfect tone, slight trace of modulation
T 9	Perfect tone, no trace of ripple or modulation of any kind

- In practice we generally use just a few levels of T with a definition which meets the general status of technology today:
  - **T1**: heavily modulated CW, signs of wild oscillation or extremely rough AC (means: get off the air with such a poor signal!).
  - **T5**: very noticeable AC component (often due to poor regulation of a power supply of the transmitter or amplifier).
  - **T7 – T8**: slightly or barely noticeable AC component.
  - **T9**: perfect tone, undistorted sine waveform.
- /Nowadays the most common CW signal deficiencies are **chirp** and even more common **key clicks** (see § II.9.25).
- A long time ago chirp and key clicks were very common problems with CW signals: every CW operator knew that a 579**C** report meant signals exhibiting chirp, and 589**K** meant signals with key clicks. Few hams nowadays know what the C and the K at the end of an RST report stand for, so better send 'CHIRP' or 'BAD CHIRP', and 'CLICKS' or 'BAD CLICKS' in full words as part of your report.
- A typical way to gracefully end the QSO would be: '…TKS (thanks) FER QSO 73 ES (=and) CUL (see you later) W1ZZZ de G3ZZZ SK'. 'SK' is the prosign meaning 'end of contact'.
- 'DIT DIT DIT DAH DIT DAH' is the prosign 'SK' (from 'stop keying') and not 'VA' as published in some places (SK sent without inter letter spacing sounds the same as VA sent without inter letter spacing).
- Do not send '…AR SK'. It does not make sense. You are saying 'end of transmission' + 'end of contact'. It is quite obvious the end of your contact is at the end of your transmission. You will quite often hear '...AR SK', but the AR is redundant, so avoid using it.
- If at the end of the QSO you also intend to close down your station, you should send: '…W1ZZZ DE G3ZZZ SK CL' ('CL' is a prosign meaning 'closing' or 'closing down').

Typical CW QSO for the beginner:

QRL?

QRL?

CQ CQ G4ZZZ G4ZZZ CQ CQ G4ZZZ G4ZZZ AR

G4ZZZ DE ON6YYY ON6YYY AR

ON6YYY DE W4ZZZ GE TKS FER CALL UR RST 579 579 MY NAME BOB BOB QTH HARLOW HARLOW HW CPY? ON6YYY DE W1ZZZ K

G4ZZZ DE ON6YYY FB BOB TKS FER RPRT UR RST 599 599 NAME JOHN JOHN QTH NR GENT GENT W1ZZZ DE ON6YYY K

ON6YYY DE G4ZZZ MNI TKS FER RPRT TX 100 W ANT DIPOLE AT 12M WILL QSL VIA BURO PSE UR QSL TKS QSO 73 ES GE JOHN ON6YYY DE G4ZZZ K

G4ZZZ DE ON6YYY ALL OK BOB, HERE TX 10 W ANT INV V AT 8M MY QSL OK VIA BURO 73 ES TKS QSO CUL BOB G4ZZZ DE ON6YYY SK

73 JOHN CUL DE G4ZZZ SK

- An overview of the *closing codes*:

CODE	MEANING	USE
AR	end of transmission	at end of CQ **and** at the end of your transmission when you call a station (1)
K	over to you	at the end of an *over* (2) **and** at the end of your transmission when you call a station (1)
KN	over to you only	at the end of an *over*
AR K	end of transmission + over to you	**do NOT use**
AR KN	end of transmission + over to you only	**do NOT use**
SK	end of contact (end of QSO)	at end of QSO
AR SK	end of transmission + end of contact	**do NOT use**
SK CL	end of QSO + closing down station	when closing down

(1) when you reply to a station calling CQ or QRZ
(2) a transmission or an over is NOT the same as a QSO (contact). A QSO usually consists of a series of overs

II.9.7. Using 'BK'

- 'BK' (*break*) is used for switching quickly back and forth between stations without exchanging callsigns at the end of the transmission. In a way it is the CW equivalent of 'over' in phone.
- Example: W1ZZZ wants to know the name of G3ZZZ he's in contact with and sends: '…UR NAME PSE BK'. G3ZZZ answers immediately: 'BK NAME JOHN JOHN BK'.
- The break is announced with 'BK', and the transmission by the correspondent starts with 'BK'. The latter *BK* however is not always sent.

II.9.8. Still faster

- Often even the 'BK' code is not used. One just stops sending (in *break in* mode, which means that you can listen between words or characters) giving an opportunity to the other station to start sending, just as in a normal face to face conversation, where the word is also passed back and forth without any formality.

II.9.9. Using the prosign 'AS' (DIT DAH DIT DIT DIT)

- If, during a QSO, someone *breaks in* (transmits his call on top of the station you are working, or gives his call when you switch over), and you want to let him know that you first want to finish the QSO, just send 'AS', which means 'hold on', 'wait' or 'stand by'.

II.9.10. Using 'KN'

- 'K' = 'over'. Sending just 'K' at the end of your over leaves the door open for other stations to break in. If you don't want to be interrupted, send 'KN'.
- 'KN' means that you want to hear ONLY the station whose callsign you just sent (= 'go ahead, others keep out' or 'over to you only'), in other words: no breakers at this time please.
- 'KN' is mainly used when chaos is around the corner. A possible scenario: different stations are coming back to your CQ. You are decoding one partial call and you send: 'ON4AB? DE G3ZZZ PSE UR CALL AGN (again) K'. The station *ON4AB?* answers you, but in addition several other stations call simultaneously, making it impossible to copy his call. The procedure is to call *ON4AB?* again and end your call with 'KN' instead of 'K', this to emphasize you only want to hear *ON4AB?* come back to you. Example: 'ON4AB? DE G3ZZZ KN' or even 'ONLY ON4AB? DE G3ZZZ KN'. If you are still short of authority on the frequency you may try 'ON4AB? DE G3ZZZ KN N N N' (keep some extra space between the letters N). Now you are really getting nervous...

II.9.11. How to answer a CQ

Assume W1ZZZ has called CQ and you want to make a QSO with him. How do you go about it?

- Do not send at a higher speed than the station you're calling.
- Do not send the call of the station you are calling more than once; most of the time the call is not sent, it is obvious who you are calling.
- You can use either 'K' or 'AR' to end your call (see § II.9.6): 'W1ZZZ DE G3ZZZ G3ZZZ K', 'G3ZZZ G3ZZZ K', 'W1ZZZ DE G3ZZZ G3ZZZ AR' or 'G3ZZZ G3ZZZ AR'.
- In many cases one sends only the callsign without any *closing code* (AR or K) at all. This is also common practice in contests.
- Do not end your call with either '...**PSE** AR' or '...**PSE** K' (see § II.9.6).

II.9.12. Someone sends an error in your call

- Assume W1ZZZ has not copied all the letters of your call correctly. His answer is something like: 'G3ZZ**Y** DE W1ZZZ TKS FOR CALL UR RST 479 479 NAME JACK JACK QTH NR BOSTON BOSTON G3ZZ**Y** DE W1ZZZ K'.
- Now you go back to him as follows: 'W1ZZZ de G3ZZZ ZZZ G3ZZZ TKS FER

RPRT…'. By repeating part of your call a few times, you emphasize this part of the call to get your correspondent's attention so he can correct the error.

II.9.13. Call a station that's finishing a QSO

- Two stations are in QSO, the QSO comes to an end. If they both sign with 'CL' ('closing down') it means the frequency is now clear as they both closed down. If one or both ended with 'SK' (end of transmission), it may well be so that one or the other will remain on frequency for more QSOs (in principle the station that initially called CQ on that frequency).
- In this case, it is best to wait a while and see if either one calls CQ again.
- Example: W1ZZZ finished a QSO with F1AA: '…73 CUL (see you later) F1AA de W1ZZZ SK'.
- As neither one calls CQ after the QSO, you can call either one.
- Assume you (G3ZZZ) want to call F1AA. How do you go about it? Simply send 'F1AA de G3ZZZ G3ZZZ AR'.
- In this case calling without mentioning the callsign of the station you want to contact would be inappropriate. Send the call of the station you want to work once, followed by your call once or twice.

II.9.14. Using the '=' sign or 'DAH DIT DIT DIT DAH'

- Some call it 'BT', because it is like a letter B and T sent without space (like 'AR' is sent without space), but simply is the equality sign (=) in CW.
- DAH DIT DIT DIT DAH is used as a ***filler*** to pause for a second while you think of what you are going to send next. It is also used as a ***separator*** between chunks of text.
- As *filler* it is used to prevent your correspondent from starting to transmit, because you haven't finished your sentence yet, or you have not finished sending what you want to send. It is clearly the equivalent of *euh* or *eh*.
- Some CW operators seem to use 'DAH DIT DIT DIT DAH' spread all over their QSOs as a *text separator*, to make the text more readable. Example: 'W1ZZZ DE G4YYY = GM = TU FER CL = NAME CHRIS QTH SOUTHAMPTON = RST 599 = HW CPI? W1ZZZ DE G4YYY KN'. The use of this separation mark seems less common nowadays, and is considered by many as a waste of time. 'W1ZZZ DE G4YYY GM TU FER CL NAME CHRIS QTH SOUTHAMPTON RST 599 HW CPI? W1ZZZ DE G4YYY KN' is as readable as the version of the text with the separators.

II.9.15. Send good sounding code

- Listening to your CW should be like listening to good music, where one never feels like *working* at deciphering an unknown code or assembling a puzzle.
- Make sure you *space* letters and words appropriately. Fast sending with a little extra spacing usually makes overall copying easier.
- Experienced CW operators don't listen for letters but for words. This can of course only be done successfully if the right spacing exists between words. Once you start hearing words instead of a stream of letters, you are getting there! In normal face to face conversation we also listen for words, not for letters, don't we?
- On an automatic keyer, adjust the DIT/space ratio (weight) correctly. It will

sound nicest (most pleasing) if the ratio is a little bit on the high side (DIT a little longer than a space), compared to the standard 1/1 ratio.
- Remark: weight is not the same as DIT/DAH ratio! The DIT/DAH ratio is usually fixed at a 1/3 ratio on most keyers (not adjustable).

II.9.16. I am a QRP station (= low power station)

- A **QRP** station is a station transmitting with a power of maximum 5 W (CW) or 10 W (SSB).
- Never send your call as 'G3ZZZ/QRP', this is **illegal** in many countries (e.g. Belgium). The QRP information is **not** part of your callsign, so it cannot be sent as a part of it. In many countries the only permitted call suffixes are /P, /A, /M, /MM and /AM..
- If you are really a QRP station, chances are that you will be *relatively weak* with the station you are calling. Adding unnecessary ballast (the slash and the letters QRP) to your callsign will make it even more difficult to decipher your callsign!
- You can of course always mention during the QSO you are a QRP station, e.g.: '…PWR 5W 5W ONLY…'.
- If you call CQ as a QRP station and you want to announce that during your CQ, you can do it as follows: 'CQ CQ G3ZZZ G3ZZZ QRP AR'. Insert a little extra space between the call and 'QRP' and do not send a slash (DAH DIT DIT DAH DIT) between your call and 'QRP'.
- If you're looking for QRP stations specifically, call CQ as follows: 'CQ QRP CQ QRP G3ZZZ G3ZZZ QRP STNS (stations) ONLY AR'.

II.9.17. The correct use of 'QRZ?'

- 'QRZ?' means 'who called me?', and nothing else. Use it when you could not quite copy the station (or stations) that called you.
- In CW always send QRZ followed by a **question mark** ('QRZ?'), as is done with all Q codes when used as a question.
- Typical use: after a CQ F9ZZZ was unable to decipher any of the callers. Then he sends: 'QRZ? F9ZZZ'.
- If you have been able to copy part of a call (ON4…), and if more stations were calling you, do not send 'QRZ' but rather 'ON4 AGN (again) K' or 'ON4 AGN KN' ('KN' indicates clearly you only want to hear the ON4 station come back to you). Note that in this case you use 'K' or 'KN' and **not** 'AR' because you turn it back to one station in particular, the ON4 station whose suffix you missed.

Don't send 'QRZ' in this case or all the stations will start calling you again.

- 'QRZ' does **not** mean 'who is there?' or 'who is on the frequency?'. Assume someone passes by a busy frequency and listens in. After quite a while nobody having identified, he wants to find out the calls. The proper way to do so is to send 'CALL?' or 'UR CALL?' (or 'CL?', 'UR CL?'). Using 'QRZ' is inappropriate here. By the way, when you send 'CALL?', you should in principle add your call, otherwise you make an unidentified transmission, which is illegal.

II.9.18. The use of '?' instead of 'QRL?'

- Before using an apparently clear frequency, you need to actively check if no one is there already (maybe you are not hearing one end of a QSO because of propagation).
- The normal procedure is: send 'QRL?' (on CW) or ask 'is this frequency in use?' on phone.
- On CW, some simply send '?', because it is faster and thus potentially creates less QRM if someone else is using that frequency.
- But '?' can be interpreted in many ways (it says: *I am asking a question, but I did not say which one…*). Therefore always use 'QRL?'. Merely transmitting a question mark can create a lot of confusion.

II.9.19. Sending 'DIT DIT' at the end of a QSO

- At the end of a QSO both QSO partners often send as very last code two DITs with some extra spacing between them (like e e). It means and sounds like 'bye bye'.

II.9.20. Correcting a sending error

- Assume you make a sending error. Immediately stop sending, wait a fraction of a second and send the prosign 'HH' (= 8 DITs). Not always easy to send exactly 8 DITs, you're already nervous because you made an error, and now they want you to send exactly 8 DITs: DIT DIT DIT DIT DIT DIT DIT DIT, not 7 nor 9!
- In actual practice, many hams send just a few (e.g. 3) DITs, with extra space in between the DITs: 'DIT _ DIT _ DIT'. These extra spaced DITs indicate that the sender is not sending the code for a letter nor figure.
- Resend the word where you made an error and carry on.
- Often even these 3 DITs are left out altogether. When the sender realizes he's sending an error, he stops for about second and starts sending the same word again.

II.9.21. CW contests

- See § II.8.6 as well.
- Contest means speed, efficiency and accuracy. Hence, send only what's strictly necessary.
- The most efficient contest CQ is as follows: 'GM3ZZZ GM3ZZZ TEST'. The word *TEST* should be placed at the end of the CQ call.
  - Why? Because anyone tuning across the frequency at the end of your CQ then knows that you call CQ.
  - Assume you end your CQ contest call with your callsign: a passer-by noticed he needs that call, but does not know whether you called someone else or

called CQ. So he has to wait one more round to find out: a waste of time.
  - Therefore, always end your contest CQ with word *TEST*. Note that even the word *CQ* is left out from a contest CQ as it contains no additional information.
- An experienced contester will come back to your CQ contest call by just giving his call once. Nothing more. Example: 'W1ZZZ'. If you don't get back to him within 1 second, he will likely send his call again unless you returned to someone else.
- You copied his call and reply to him as follows: 'W1ZZZ 599001' or 'W1ZZZ 5991' provided the contest rules admit you to drop the leading zeros. Still faster would be to use *cut numbers* (abbreviated numbers): 'W1ZZZ 5NNTT1' or 'W1ZZZ 5NN1' (see § II.9.22)
- In most contests the exchange consists of a RST report followed by e.g. a serial number. Do not send anything else. No 'K' at the end, no '73', no 'CUL' (see you later), no 'GL' (good luck); there is no room for all of this in a contest where *speed* is the name of the game.
- Ideally W1ZZZ will answer e.g. as follows: '599012' or '5NNT12'.
- If he did not copy your report he would have sent: 'AGN?'. As he did not do that, it means that your report was received OK. No need to send 'TU', 'QSL', 'R' or whatever else to confirm reception of the report. It is a waste of time.
- All that's left to be done is to end the contact. A polite way of doing this: 'TU GM3ZZZ TEST'. *TU* says the QSO is over (thank you), *GM3ZZZ* identifies you for stations wanting to call you and *TEST* is a new CQ contest. If the QSO rate is very high, you can leave out the *TU*.
- There are of course slight variations possible, but the key words are speed, efficiency and accuracy.
- Most contesters use a computer contest program, which in addition to logging also allows them to send CW via pre-programmed short messages (CQ, reports etc.). A separate CW paddle and keyer allows for the operator to manually intervene if necessary. Such a setup makes long contests less tiring and will increase accuracy. Contest logging with pen and paper is almost history.
- If you want to look for *multipliers* or stations you have not yet worked, you will need to scan the band looking for such stations. When you find one, call as follows: 'GM3ZZZ'. Do not send his callsign, it's a waste of time. You can be sure the operator knows his own call. And he also knows you are calling him, because of the timing and of the fact that you give your call on the frequency where he is operating! Also, do not send 'DE GM3ZZZ', the word *DE* contains no additional information.
- If he does not come back within a second, give your call again, etc.

Example of a CW contest QSO:

DL0ZZZ TEST (CQ call from DL0ZZZ)

G6XXX (G6XXX calls DL0ZZZ)

G6XXX 599013 (DL0ZZZ gives G6XXX a report)

599010 (G6ZZZ gives DL0ZZZ his report)

TU DL0ZZZ TEST (DLOZZZ confirms reception and calls CQ Contest)

II.9.22. Abbreviated numbers (cut numbers) used in contests

- The code to be exchanged in most contests consists of a series of numbers, e.g. RST, followed by a 3-digit serial number.
- To save time, the CW code for some numbers (digits) is often shortened (cut):

  1 = A (DIT DAH, instead of DIT DAH DAH DAH DAH)
  2, 3 and 4 are usually **not** abbreviated
  5 = E (DIT instead of DIT DIT DIT DIT DIT)
  6, 7 and 8 are usually **not** abbreviated
  9 = N (DAH DIT instead of DAH DAH DAH DAH DIT)
  0 = T (DAH instead of DAH DAH DAH DAH DAH)

- Example: instead of sending '599009' one could send 'ENNTTN'. Most frequently you will hear '5NNTTN'. As we expect numbers, and although letters are received, we write down numbers. The better computer contest programs allow you to type in letters (in the exchange field); the program will automatically convert these letters to numbers.
- A4 instead of 14 (or a5 instead of 15 etc.): in some contests (e.g. CQ WW) you need to send your CQ zone number as part of the contest exchange. Instead of sending e.g. '59914' we often send '5NNA4' or even 'ENNA4'.

II.9.23. Zero beat

- A major advantage of a CW QSO is the narrow bandwidth such a QSO uses (a few hundred Hz), provided both stations in a QSO transmit on the exact same frequency.
- For most standard contacts, both stations will transmit on one and the same frequency (**simplex** operation). They are said to be ***zero beat*** with one another.
- The term *zero beat* comes from the fact that if two stations transmit on exactly the same frequency, the resulting beat from mixing the two signals would have a frequency of zero Hz: these signals are said to be *zero beat*.
- Often however, they do not transmit on exactly the same frequency. For this there are two major reasons (often a combination of both):

  - One of them is the incorrect use of the RIT (Receiver Incremental Tuning) on the transceiver. Most modern transceivers have an RIT function which makes it possible to listen on a frequency which is (slightly) different from the transmit frequency.
  - A second reason is that the operator does not apply the correct zero beat procedure. With most modern transceivers the zero beat procedure consists of making sure that the pitch of the side tone (CW monitor signal) of the transmitter is at exactly the same frequency as the tone (pitch) of the station you listen to. If you listen at 600 Hz and the side tone pitch is set at

1.000 Hz, you will transmit 400 Hz away from the station you are calling.

- On modern transceivers the frequency of the CW side tone monitor (pitch) is adjustable, and tracks the BFO frequency offset.
- Many experienced CW operators listen at a fairly low beat tone (400 – 500Hz, sometimes even as low as 300 Hz) instead of the more usual 600 – 1,000 Hz. For most people a lower pitch frequency is less tiring during long periods of listening and, in addition it allows for better discrimination between close spaced signals.

II.9.24. Where can one find slow speed CW stations (QRS)?

- 80 m: 3.550 - 3.570 k
- 20 m: 14.055 - 14.060 kHz
- 15 m: 21.055 - 21.060 kHz
- 10 m: 28.055 - 28.060 kHz

- *QRS* means : send more slowly
- *QRQ* means : send faster

II.9.25. Do I have key clicks?

- Not only the content and the format of what you send needs to be OK … but also the quality of the CW signals you transmit must be good.
- Quality problem # 1 is **key clicks**.
- Key clicks are always shown by the envelope waveform of the transmitted signal looking like a (nearly) perfectly square wave, with no rounded off edges, often including overshoot leading end spikes. All of this results in wide sidebands, which are witnessed as *clicks* left and right of the CW signal. There are three main technical causes for this problem:

  - One is an improperly shaped keying waveform containing a lot of harmonics (square edges). The cause of this is most often a poor circuit design by the manufacturer. Fortunately, a number of circuit changes have been published on internet to solve these problems.
  - The second one is having too much driving power to the amplifier combined with improper ALC (*automatic level control*) action (too slow attack time), resulting in leading edge spikes. It is always recommended to manually adjust the required drive power and not to rely on action of an ALC circuit.
  - A third one is improper open/closure sequence timing of RF relays in full break in.

- How can you detect key clicks generated by your own station? A well experienced ham in your close neighbourhood can listen carefully for clicks.
- Much better is to continuously monitor all transmissions using an oscilloscope displaying the waveform of your transmitted signal.
- Note that even some of the popular fairly recent commercial transmitters have outspoken key clicks.
- If you notice key clicks on your transmission or if you get reports on excessive key clicks, correct the problem or find help to do so. Your key clicks are causing problems with your other hams. Hence getting rid of your key clicks is a question of *ethics*!

II.9.26. Too fast?

- Is the CW speed you master not high enough to be able to make many QSOs?
- To increase your receiving speed, you need to exercise at a speed which is at the limit of your capabilities, where you gradually and constantly increase the speed (à la RUFZ, see § II.9.27).
- Up to approx. 15 WPM you can write down a text sent in CW letter by letter.
- At over 15 or 20 WPM you should recognize words, and write down only what's essential (name, QTH, WX, power, antenna etc.).

II.9.27. CW training software

- UBA CW course on the UBA-website (www.uba.be)
- G4FON Koch method trainer (www.g4fon.net)
- Just learn Morse code (www.justlearnmorsecode.com)
- Contest simulation (www.dxatlas.com/MorseRunner)
- Increase your speed using RUFZ (www.rufzxp.net)
- etc.

A few important hints:

- Never learn CW by counting *DITs* and *DAHs*...
- Never learn CW by grouping together similar characters (e.g. e, i, s, h, 5): this will make you count *DITs* and *DAHs* forever!
- Never describe the CW code for a character using the words *dot* and *dash* but rather using the words ***DIT*** and ***DAH***. *Dots* and *dashes* make us think of something visual, *DITs* and *DAHs* make us rather think of sounds.

II.9.28. Most used CW abbreviations

AGN:	again
ANT:	antenna
AR:	end of message (prosign)
AS:	wait a second, hold on (prosign)
B4:	before
BK:	break
BTW:	by the way
CFM:	(I) confirm
CL:	call
CL:	closing (down) (prosign)
CQ:	general call to any other station
CU:	see you
CUL:	see you later
CPI:	copy
CPY:	copy
DE:	from (e.g. W1ZZZ de G3ZZZ)
DWN:	down
ES:	and
FB:	fine business (good, excellent)
FER:	for

GA:	go ahead
GA:	good afternoon
GD:	good
GD:	good day
GE:	good evening
GL:	good luck
GM:	good morning
GN:	good night
GUD:	good
HI:	laughter in CW
HNY:	Happy New Year
HR:	here
HW:	how (e.g. HW CPY)
K:	over to you
KN:	over to you only, go ahead please and others keep out
LP:	long path (propagation)
LSN:	listen
MX:	Merry Christmas
N:	no (negation)
NR:	number
NR:	near
NW:	now
OM:	old man (male ham)
OP:	operator
OPR:	operator
PSE:	please
PWR:	power
R:	roger, yes, I confirm, received
RCVR:	receiver
RX:	receiver
RIG:	equipment
RPT:	repeat
RPRT:	report
SK:	end of contact (prosign)
SK:	silent key, a deceased ham
SP:	short path (propagation)
SRI:	sorry, excuse me
TMW:	tomorrow
TMRW:	tomorrow
TKS:	thanks
TNX:	thanks
TRX:	transceiver
TU:	thank you
TX:	transmitter
UFB:	ultra fine business
UR:	your
VY:	very
WX:	weather

XMAS:	Christmas
XYL:	wife, spouse, ex-young lady
YL:	young lady
YR:	year
51 and 55	is CB slang. Do not use it.
73:	best regards 73 is also commonly used in phone: never say or write *73s*, *best 73* or *best 73s*; all of these are corruptions. Say *seventy three* and NOT *seventy three**s***.
88:	love and kisses. Same remarks as for '73'.

SUMMARY (most important Q codes and prosigns)

- **AR:** *end of transmission*: indicates the end of a transmission which is not addressed to anyone in particular (e.g. at the end of a CQ)
- **K:** *over to you*: ends a transmission of a conversation between 2 or more stations.
- **KN:** *over to you only*: similar to 'K' but you emphasize you do not want to hear any other callers or breakers.
- **SK:** *end of QSO*: is used to end a QSO (SK = Stop Keying).
- **CL:** *closing down station*: last code sent before closing down your station (CL = closing down)
- **QRL?:** *is the frequency in use?*: you must always use it before calling CQ on a new frequency.
- **QRZ?:** *who called me?*: QRZ has **no** other meaning.
- **QRS:** *reduce your sending speed*
- **AS:** *just a moment, hold on…*
- **= :** *I am thinking, hold on, uh…* (also used as a separator between portions of text)

II.10. OTHER MODES

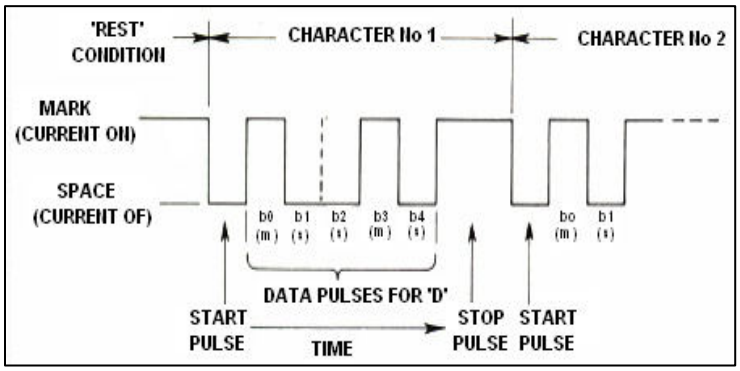
So far we have discussed operational behavior for phone and CW operating in great detail, as these are by far the most frequently used modes in amateur radio. You will have noticed that general operational behavior is very similar in both modes, and differences are mainly due to the use of the Q code, prosigns and other specific terminologies.

The basic procedures as outlined for phone and CW apply to most of the other frequently used modes, such as RTTY, PSK(31), SSTV etc.

Radio amateurs also use highly specialized modes such as Fax, Hell (schreiber), contacts through satellites, EME (moonbounce, Earth Moon Earth), meteor scatter, Aurora, ATV (wideband amateur television), etc., which, to a certain extent, may call for specific operational procedures.

In the next few pages we will cover some of these *other* modes.

II.10.1. RTTY (Radioteletype)



II.10.1.1. What is RTTY?

- RTTY is the oldest of the digital modes used by hams, if you exclude CW, which really is also a digital mode. RTTY is used to send and receive text. The code used in RTTY was developed to be generated and decoded by a machine. In the old days (the days of *Telex* machines), these were mechanical machines that generated and decoded the *Baudot* code, which is the original teleprinting code invented in 1870! Each character typed on the machine keyboard is converted to a 5 bit code, preceded by a start bit and followed by a stop bit. With 5 bits one can, however, only obtain 32 possible combinations (2^5 = 2x2x2x2x2). As we have 26 letters (in RTTY only uppercase letters are available) plus 10 figures and a number of signs, the Baudot code has given 2 different significations for each 5 bit code, which depend on the state the RTTY machine is in. These states are the so-called *LETTERS* and *FIGURES* states. If the machine is sending letters, and needs to send figures, it will first send a 5 bit code corresponding to *FIGURES*. This code will set the machine (or software) in the *FIGURES* state. If this code is not received, the following figures will be printed as (the equivalent code) letters. This is a frequently occurring error that all RTTY operators are well acquainted with, e.g. while receiving the RST report (*599* is received as *TOO*). Nowadays, RTTY is almost exclusively generated using a PC with sound card, using dedicated software.
- On the amateur bands the Baudot code is transmitted by FSK (Frequency Shift Keying). The transmitter carrier is shifted 170 Hz between on and off (called **mark** and **space** in RTTY). In the early days of RTTY the shift was 850 Hz. The Baudot code does not contain any error correcting mechanism. The standard speed used on the amateur bands is 45 Baud. Using a 170 Hz shift, the –6dB bandwidth of the FSK signal is approximately 250 Hz.
- As RTTY is simply the shifting of a (constant) carrier, the *duty cycle* of the transmitted signal is 100% (versus approximately 50% in CW and 30 to 60 % in SSB depending on the degree of speech processing). This means that we shall never push a 100 W transmitter (100 W in SSB or CW) over 50 W output in RTTY (for transmissions lasting longer than a few seconds).

II.10.1.2. RTTY frequencies

- Before 2005, IARU subdivided the various ham bands *by modes* (phone band, CW band, RTTY band etc.). As the Band Plan since 2005 is based on *transmitted signal bandwidth* rather than mode, the Band Plan can be quite confusing for newcomers and old timers alike.
- We therefore have listed the range of frequencies which are most frequently used for each mode. These frequencies may be slightly different from what you find in the IARU Band Plan in as far as we can compare modes with bandwidth, which is not always obvious. The table below is not meant to replace the IARU

Band Plan.

160m:	1.838 – 1.840 kHz.	Very little RTTY on 160m. Stay with the entire signal in this window USA: 1.800 – 1.810 kHz (not allowed in Europe)
80m:	3.580 - 3.600 kHz	Japan: 3.525 kHz
40m:	7.035 - 7.043 kHz	
30m:	10.140 - 10.150 kHz	
20m:	14.080 - 14.099 kHz	
17m:	18.095 - 18.105 kHz	
15m:	21.080 - 21.110 kHz	
12m:	24.915 - 24.929 kHz	
10m:	28.080 - 28.150 kHz	

II.10.1.3. Specific operational procedures

- All standard phone and CW procedures apply.
- RTTY is extremely sensitive to QRM (all kinds of interferences). Pileups must be run in the split frequency mode (see § III.1).
- The Q codes were originally developed for use in CW. Later, hams started using a number of these codes in phone, where they have been widely accepted. One can of course also use these Q codes in the newer digital modes such as RTTY and PSK (See § II.10.2) rather than to develop another set of codes of their own, which would inevitably lead to confusion.
- In the digital modes all computer programs provide the facility to create files with short pre packaged *standard* messages that can be used in a QSO. An example is the so-called *brag tape* that sends endless information about your station and your PC. Please do not send all these details unless your correspondent asks for it. A brief 'TX 100 W, and dipole' will be sufficient in most cases. Just give information your correspondent could be interested in. Don't end your QSO by sending the time, the number of the QSO in your log etc. This is worthless information. Your correspondent also has a clock and he does not care how many QSOs you have already made. Respect your correspondent's choice, and don't force him/here to read all that garbage.

Typical RTTY QSO:

QRL? DE PA0ZZZ

QRL? DE PA0ZZZ

CQ CQ DE PA0ZZZ PA0ZZZ PA0ZZZ AR

PA0ZZZ DE G6YYY G6YYY K

G6YYY DE PA0ZZZ GA (good afternoon) OM TKS FER CALL UR RST 599 599 NAME BOB BOB QTH ROTTERDAM ROTTERDAM HW CPI? G6YYY DE PA0ZZZ K

PA0ZZZ DE G6YYY GA BOB UR RST 599 599 NAME JOHN JOHN QTH LEEDS LEES PA0ZZZ DE G6YYY K

G6YYY DE PA0ZZZ TKS RPRT JOHN STN 100 W ANT 3 EL YAGI AT 18M WX RAIN PSE QSL MY QSL VIA BUREAU 73 AND CUL G6YYY DE PA0ZZZ K

PA0ZZZ DE G6YYY ALL OK BOB QSL VIA BUREAU 73 AND TKS QSO PA0ZZZ DE G6YYY SK

73 G6YYY DE PA0ZZZ SK

II.10.1.4. Nominal transmit frequency on RTTY

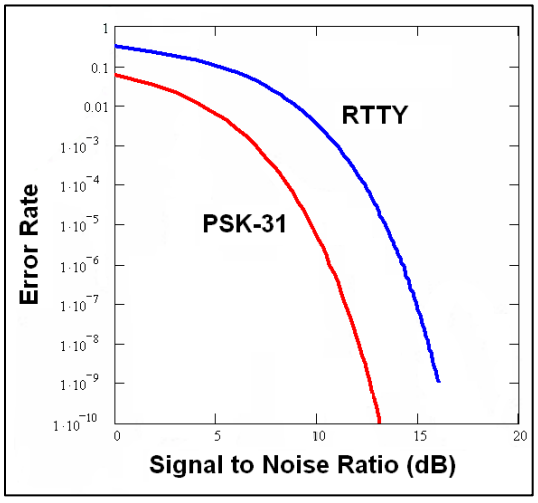
- Two definitions were made long time ago:
  1. The frequency of the **mark signal** determines the **nominal frequency** of an RTTY signal.
  2. The **mark signal** must always be **transmitted** on the **highest frequency**.
- If we listen to an RTTY signal, how can we tell which of the 2 tones is the mark signal? If you receive the signal on USB (upper sideband), the mark signal is the signal that has the higher audio tone. In LSB it is, obviously, the other way around.
- RTTY usually employs one of three methods to be generated in a transmitter:
  1. **FSK** (Frequency Shift Keying): the carrier is shifted according to modulation (mark or space). RTTY is actually FM. All modern transceivers have an FSK position on the mode selector switch. These transceivers all indicate the correct frequency on the digital display (being the mark frequency), provided that the modulating signal (the Baudot code) is of the correct polarity. You can usually invert the logic polarity either in your RTTY program or on your transceiver, or both (positions *normal* and *reverse*). If not set correctly, you will be transmitting *upside down.*
  2. **AFSK** (Audio Frequency Shift Keying): in this method the Baudot code modulates a generator which produces two audio tones, one for mark and one for space. These audio tones must fall within the audio passband of the transmitter. Modern RTTY programs on a PC generate these two tones using the soundcard. These tones serve to modulate the transmitter in SSB.
     a. on **USB**: in this method the transmitter, in upper sideband position, is modulated by the AFSK audio tones. Assume you transmit on 14090 kHz (zero beat frequency or suppressed carrier frequency on SSB). If you modulate your transmitter with two audio tones being e.g. 2.295 Hz for mark and 2.125 Hz for space, the mark signal will be transmitted on **14.092,295 kHz** and the space signal on 14.092,125 kHz. This agrees with the definition given above (mark → highest frequency). Watch out, your transmitter will indicate 14.090 kHz on its dial! In other words, if properly modulated (tones not inverted) and when using 2.125 Hz (space) and 2.295 Hz (mark) as modulation tones, **you simply add 2.295 Hz to the SSB dial reading** (the nominal SSB frequency) of your transceiver to obtain the nominal RTTY frequency.
     b. on **LSB**: same as above but transmitted in LSB. Here, the two transmitted frequencies will be below the suppressed carrier frequency. If

we use the same frequencies for the mark and space tones as for USB (mark = 2.295 Hz and space = 2.125 Hz), the **mark signal** will now be on 14.090 – 2.295 = **14.087,705 kHz** and the space signal on 14.087,875 kHz. This does **not** meet the definition that the mark signal always is the signal with the highest frequency. Therefore, we have to invert the modulating audio tones on LSB. Note that here too the transmitter dial will indicate 14.090 kHz! In this case (now 2.125 Hz is the mark frequency and 2.295 Hz the space frequency) we shall **subtract the frequency of the mark tone** from the nominal SSB frequency (shown on the dial of the transceiver) to obtain the nominal RTTY frequency. Using the same example: 14.090 kHz – 2,125 kHz = **14.087,875 kHz**.

- Why is it so important to know the correct nominal frequency? Assuming you'd like to spot an RTTY station on a DX Cluster, it is better to give the correct frequency and not something that may be a couple of kHz off.
- Another reason is the need to stay within the frequency ranges of the IARU Band Plan for RTTY. Example: according to the Band Plan 14.099 - 14.101 is reserved for beacons (e.g. the NCDXF beacon network). This means that if you use AFSK with 2.125 (space) and 2.295 Hz (mark) as modulating tones in USB, you should never transmit with a **dial reading** on your transmitter higher than 14.099,000 – 2.295 = 14,096.705 kHz. Taking into account the effect of the sidebands, it is safe to round off this figure to 14,096.5 kHz.
- Why do we use such high frequencies (2.125 and 2.295 Hz) for the AFSK generator? To achieve extra attenuation of any harmonics of these audio signals, by having all harmonics fall outside the SSB filter passband.
- If at all possible, use your transmitter in FSK rather than AFSK to generate RTTY signals. In most cases the quality of signals generated in FSK is far superior.

II.10.2. PSK 31 (Phase Shift Keying)

II.10.2.1. What is PSK31?



- PSK31 is a digital mode, designed for keyboard-to-keyboard communications via radio. This mode uses the soundcard in your computer to convert your typewritten messages into a modulated audio signal, and to convert received PSK-31 audio signals into text.
- The PSK31 signal, operating at 31,25 bauds (which is ample for hand typed messages), has, theoretically, an extremely narrow bandwidth of 31 Hz at – 6dB (in practice bandwidth is approx. 80 Hz). PSK31 does not include an error correcting algorithm. But for S/N ratios greater than 10 dB, PSK31 is virtually error free. At lower S/N ratio's, PSK31 is approximately 5 times better than RTTY.
- Each of the characters of the Baudot code, used in RTTY, uses a binary code

composed of a fixed number of 5 bits, which means that the length of each of those is the same. PSK31 however uses a ***varicode***, which means a code of **variable length**. Example: The letter 'q' is coded by not less than 9 bits ('**110111111**') , while the letter 'e' only contains 2 bits ('**11**'). On average a character contains 6.15 bits. Most lowercase PSK31 characters have fewer bits in them than their upper-case equivalents, so it takes less time to transmit lower-case characters.

- Unlike RTTY, the transmission of PSK31 signals does not use a start or a stop bit. Instead of using two frequencies to transmit the code, as is done in RTTY (using FSK), PSK31 uses a single frequency, of which the phase is changed (by 180°) to transmit logic states 1 and 0.

II.10.2.2. PSK31 frequencies

The table below does not replace the IARU Band Plan, but gives a picture of the various band segments as they are actually being used in PSK31:

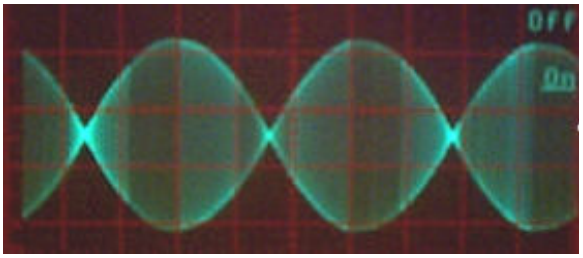
160m: 1.838 - 1.840 kHz
80m: 3.580 - 3.585 kHz
40m: 7.035 – 7.037 kHz (7.080 in Region 2)
30m: 10.140 - 10.150 kHz
20m: 14.070 - 14.075 kHz
17m: 18.100 - 18.102 kHz
15m: 21.070 - 21.080 kHz
12m: 24.920 - 24.925 kHz
10m: 28.070 - 28.080 kHz

II.10.2.3. Adjusting the transmitter for PSK31

PSK31 is a popular digital mode where excellent results can be obtained using fairly low power and simple antennas. Its intrinsic bandwidth is very small, but it is very easy to overmodulate the transmitter, resulting in a very wide signal. Therefore it is very important to adjust the equipment correctly.

A few guidelines:

- Keep audio processing and/or speech processing switched off *at all times*.
- Set the transceiver in USB mode (LSB is also possible, but normally USB is used).
- Run as little power as necessary to have a solid QSO.
- Use an oscilloscope to monitor the waveform of your transmitted signal. The picture shows the waveform of a well adjusted PSK31 signal, which resembles the waveform of a two-tone test, used for measuring PEP power in SSB.

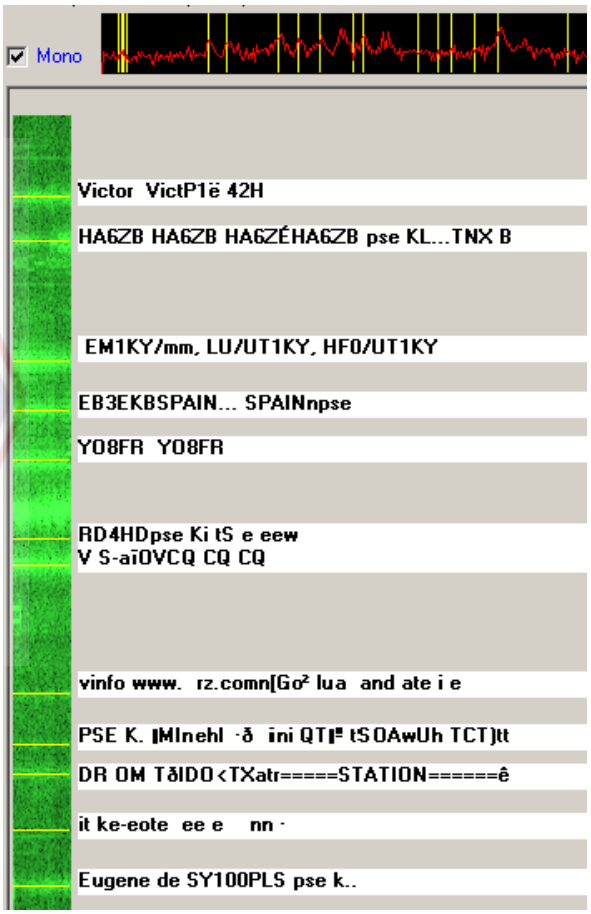


- When running 100W PEP, the power meter of the transmitter will indicate 50 W, provided the transmitter is not overmodulated. A 100 W transmitter can be run at 100 W PEP (not average!) for long periods of time (the wattmeter indicating 50 W). The *duty cycle* is 50%.
- Small dedicated test equipment is now also available for monitoring the quality of the outgoing signal, e.g. the PSKMETER by KF6VSG

(www.ssiserver.com/info/pskmeter/) or the IMDmeter by KK7UQ (kk7uq.com/html/imdmeter.html). The use of such equipment or an oscilloscope is highly recommended.

II.10.2.4. Receiving PSK31 signals

- Some software makes it possible to decode dozens of PSK31 signals simultaneously. With such software you can monitor a whole chunk of the spectrum if you use a relatively wide filter in the receiver (e.g. 2,7 kHz). The waterfall spectrum shows all of the signals in that passband and all of these are being decoded on the screen. This is the ideal way of operating in **monitoring** mode or when you go ***search and pounce*** (hopping back and forth between stations on the band).
- If you want to really dig in the noise or just work stations on one and the same frequency, the narrowest filter in your receiver (e.g. 200 Hz) will give you improved performance (better signal to noise ratio, no reduction of receiver sensitivity due to AGC action triggered by strong adjacent stations within the receive passband, less chance of intermodulation etc.). In this case the waterfall display will only show you one station.


Mono
Victor VictP1ë 42H
HA6ZB HA6ZB HA6ZÉHA6ZB pse KL...TNX B
EM1KY/mm, LU/UT1KY, HF0/UT1KY
EB3EKBSPAIN... SPAINnpse
YO8FR YO8FR
RD4HDpse Ki tS e eew
V S-aiOVCQ CQ CQ
vinfo www. rz.comn[Go² lua and ate i e
PSE K. ▮MInehl ·ð ini QT▮ª tSOAwUh TCT)tt
DR OM TðIDO<TXatr=====STATION======ê
it ke-eote ee e nn ·
Eugene de SY100PLS pse k..

II.10.2.5. Nominal PSK31 frequency

- If you operate in the wide bandwidth mode with e.g. 2,7 kHz bandwidth, the easiest is to set your transceiver precisely at a *round figure* frequency, e.g. 14.070,000 kHz. When you select a station on the waterfall display (you usually have to click on it), the software will show the nominal audio frequency of the station you selected, e.g. 1.361 Hz. In that case, and assuming you work on USB, the transmit frequency of that station is 14.070,000 kHz + 1.361 Hz = 14.071,361 kHz.

II.10.2.6. The RSQ report system

The traditional RST signal report is not really suitable to be applied meaningfully to the digital modes such as PSK31, causing the majority of operators to give contest style 599 reports regardless of the true merit of the received communication. RSQ (Readability, Strength, Quality) has been adapted from RST to provide a more meaningful signal report for HF digital modes.

- **RSQ readability:** the descriptive table (shown below) has a corresponding range of percentage readable text. This is consistent with the common practice of providing a percentage figure during a QSO.

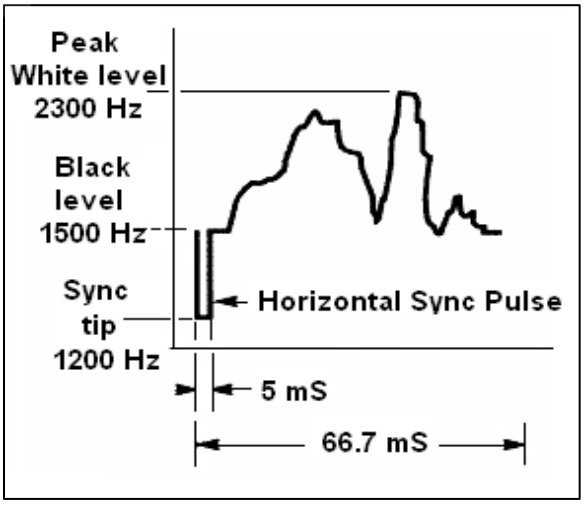
- **RSQ strength:** most HF digital mode programs provide a broadband waterfall or spectrum display. Hence a visible measure of signal trace relative to noise is more meaningful than an S-meter reading that averages the strength of all signals in the pass band.
- **RSQ quality:** the presence of additional unwanted trace modulation observed on the waterfall or spectrum display indicates possible spurious emissions (mainly caused by overmodulation) and provides a sound basis for assessing the quality of digital mode signals.

Readability	**R5**	> 95% perfectly readable
	R4	80 % practically no difficulty, occasional missed characters
	R3	40 % considerable difficulty, many missed characters
	R2	20 % occasional words distinguishable
	R1	0 % undecipherable
Strength	**S9**	Very strong trace
	S7	Strong trace
	S5	Moderate trace
	S3	Weak trace
	S1	Barely perceptible trace
Quality	**Q5**	Clean signal – no visible unwanted sidebar pairs
	Q4	One barely visible pair
	Q3	One easily visible pair
	Q2	Multiple visible pairs
	Q1	Splatter over much of the spectrum

(Source: http://www.rsq-info.net/)

II.10.3. SLOW SCAN TV (SSTV)

II.10.3.1. What is SSTV?



- Slow Scan TV is a picture transmission mode, capable of transmitting and receiving static pictures via radio. It is **Narrowband Television**. Broadcast quality TV requires a bandwidth of 5 to 10 MHz and transmits 25 or 30 pictures per second. The maximum bandwidth of SSTV is approx. 2,7 kHz (the bandwidth of an SSB signal). Black is represented by a 1.500 Hz tone and white by a 2.300 Hz tone together with a sync pulse at 1.200 Hz, well below the black level so it is invisible. The sync pulses that are sent at the end of each line are 5ms in length and at the end of each frame 30ms in length.
- SSTV is **not** a digital mode like RTTY and PSK31. It is an analogue mode like SSB. It uses frequency modulation, whereby every different value of brightness

of a spot in the image is represented by a different audio frequency. Color is achieved by sending the brightness of each color component (usually red, green and blue) separately and sequentially. On HF this audio signal is then fed into an SSB transmitter. On VHF, FM modulation is also used. There are 27 different modes of transmission (sometimes called *protocols*), the most popular ones being Scottie One and Martin One. Most software will handle the different modes.

- Nowadays PCs are widely used as SSTV decoders/generators. The SSTV program generates the signal to be transmitted using the soundcard, while on reception the sound of the SSTV signal will be converted in the same soundcard into the digital data to generate a picture through the SSTV software program.
- As SSTV is the transmission of a continuous tone of varying frequency and constant amplitude, it means that the *duty cycle* is 100%. For most commercial transmitters, it means that you will have to run maximum 50% of the peak power the transmitter can run in SSB, just like in RTTY.

II.10.3.2. SSTV frequencies

The table below does not replace the IARU Band Plan, but gives an overview of the various band segments as they are actually being used in SSTV:

80m: 3.735 +/- 5 kHz in LSB
40m: 7.035 – 7.050 kHz in LSB
30m: very little SSTV (narrow band)
20m: 14.220 -14.235 kHz in USB
17m: very little SSTV (narrow band)
15m: 21330 - 21.346 kHz in USB
12m: very little SSTV (narrow band)
10m: 28.670 - 28.690 in USB

II.10.3.3. Operating SSTV

To stay within the limits of the rules and good behavior, we should only transmit images related to our hobby (test pictures, schematics, sketches, as well as pictures of equipment, the station, the operator, the antennas, etc.) or very neutral pictures (landscapes, flowers, QSL card). More generally, the content of the images sent should meet the rules as explained in § II.7.

If you are interested in SSTV, start by spending a lot of time monitoring the SSTV frequencies and testing the available software.

A few operational hints:

- prior to making any CQ call, listen for a while to make sure the frequency you intend to use is clear,
- next, ask a few times 'is this frequency in use?'. If there is no reply, make your CQ call;
- it's a good idea always to precede pictures with a phone CQ ('CQ SSTV, this is...');
- always announce the mode (protocol) of transmission before sending a picture;

- do not break in on a QSO by sending a picture. Use SSB to do so;
- never send a picture to another station without his invitation or OK to do so;
- never transmit a series of pictures one after the other without any reasonable pause. The object of SSTV is to make a QSO and not to put on a slide show;
- always ask the station you want to work if he is ready to copy your picture;
- DX stations often work from a list, which they have taken previously on the frequency;

- it is nice to show both your call and the call of the station you are working on the image you are sending;
- try to use images with plenty of contrast, and if text is part of it, show it in large, bold letters.

II.10.3.4. The RSV report used in SSTV

- In SSTV we do not exchange an RS report (phone) nor an RST report (CW), but an **RSV**-report where V stands for **V**ideo and reports the Image Quality.
- R stands for readability (1 to 5) and S for Strength (1 to 9), as used on phone and on CW.

V = 1	heavy QRM and image deformation, parts of image indiscernible
V = 2	heavily distorted image, callsign barely readable
V = 3	average quality image
V = 4	good image, little deformation, little interference
V = 5	perfect image

III. ADVANCED OPERATING

III.1. PILEUPS

- Chances are that sooner or later you will be hit by the DX bug, if you have not been yet. In that case you will inevitably be confronted with pileups.

III.1.1. Simplex pileup

- Both the DX station and the callers are on one and the same frequency.
- The main merit of this method is that it is space conservative (only one frequency being used).
- It is an inefficient method of operating when *many* stations are calling. Depending on the expertise of the DX station, *many* can mean as few as 5 stations. Under such circumstances the QSO rate will be slow.
- What starts as a simplex pileup often evolves into a split pileup.

III.1.2. Split (frequency) pileup

- Most QSOs are made when both stations transmit on exactly the same frequency.
- When the DX station is confronted by an ever growing simplex pileup, his QSO rate will likely go down for one or more of the following reasons:
  - interference from stations calling one on top of the other;
  - the callers will have difficulty copying the DX station because some (many) of them call while the DX station is transmitting;
  - more and more stations don't hear or do not follow the instructions given by the DX station;
- In order to be heard by the callers, the DX station operator will move the pileup: he will listen on a frequency away from his transmit frequency (often 5 kHz or more). The net result is that the calling stations no longer interfere with the DX station's transmissions, as they are now on separate frequencies.
- The problem however remains that the DX station still has to listen to the *single frequency* pileup in order to pick out stations one by one.
- To maximize his chances of doing so, he will spread out the pileup, and listen over a certain frequency range, e.g. '5 to 10 up'.
- This method of course uses more frequency spectrum than strictly necessary. The spread should be kept as small as possible, to leave room for other stations.
- Out of consideration for other spectrum users (other than those wanting to work the DX station) it is recommended only to use the split frequency method if the pileup has grown too large to be handled successfully using the *simplex* method.

III.1.3. How to behave in a pileup?

- Never call the DX station if you cannot copy him well enough.
- Make sure your station is properly adjusted before calling.
- Do **not** tune your transmitter on the frequency where the DX station is transmitting.
- Is the antenna in the right direction?
- Have you heard the instructions of the DX station? If not, wait and listen for instructions first!
- Listen.
- Listen.
- Listen and get acquainted with the **operating rhythm** of the DX station.
- If you hear frustrated hams making comments on the DX station's frequency: keep quiet and wait until the chaos has subsided.

Only if all these requirements are met, can you call the DX station!

III.1.4. Simplex pileup in phone

How do you *break* through a simplex pileup?

- Never call before an ongoing QSO is completely finished. This means: no tail-ending (see § III.2).
- **Correct timing** is the *key to success*. Do not start calling immediately, instead, wait until most of the noise on frequency has died down somewhat and chances

of getting through are increased. This is not a competition where you need to be the first and fastest caller! What is important is to call at the right moment. Wait a number of seconds until the most excited callers have stopped calling and the QRM has died down somewhat, before giving your call. This may be several seconds (5 to even 7 seconds).

- How should you call? Never give the call of the DX station you are calling; the DX station certainly knows his own call. Send your full call **just once**. Partial calls are **bad**. Not 'zulu zulu zulu' but 'golf three zulu zulu zulu'. Giving just part of your call creates confusion and lengthens the whole procedure.
- Yes, you will hear many stations giving only part of their call. It is bad practice and it is also illegal.
- Do not speak too fast nor too slowly, act normally (don't shout).
- **For spelling, use only the international spelling alphabet** (see attachment 1). No fantasies!
  - In radio traffic the phonetic alphabet (Alpha through Zulu), prescribed by the ITU, serves to avoid mistakes during exchanges of letters and words. To achieve this goal a **unique** phonetic word has been attributed to each letter of the alphabet. Note there is only one such series of words, and not one for each language!
  - A DX station listens for these unique words in the pileup cacophony. His ears are tortured by the chaotic presence of all these words (and figures) and fatigue increases. If we use other words than the standard words of the spelling alphabet, the procedure may become very inefficient because we're using words that the DX station does not expect to hear.
  - Far too often in pileups one can notice that the DX station missed just **that** letter that deviated from the standard alphabet, and consequently he has to ask for a repeat. Example: The spelling word 'Lima' cuts like a razor blade. Often we hear 'London' as an alternative. If your signal is very weak or interfered with, the DX station will probably understand 'Lima' but not 'London'!
  - Not only is the DX station listening for the exact words, he is also expecting certain consonants/sounds in these words and a defined number of syllables. If a syllable gets lost due to static (QRN) or QRM, he can often reconstruct the word by completing the missing consonants and/or number of syllables.
  - Only use **the correct English pronunciation** for the spelling words**.** Attachment 1 lists the phonetic pronunciation for each of these words. Of course, when you converse in your native language, which is different from English, you have a little more leeway.
- The DX station caught only a part of your call and says: '3ZZZ you're 59, QSL?'. This means: *the station with the call ending in 3ZZZ, you are 59, copy?*
- In your reply you should now emphasize the missing part of your call: 'this is _golf three, _ golf three zulu zulu zulu, 59 QSL?' (_ indicates a little extra pause).
- Normally the DX station should answer 'G3ZZZ thanks' whereby he confirms your call and ends the QSO. If he did not confirm the correction of your callsign, call again and ask: 'please confirm my call, G3ZZZ over'. Keep insisting for a confirmation, to avoid being incorrectly logged. If he does not confirm your call, there is no reason not to call him again, until you have heard

the DX station say your call correctly.

- If the DX station returns with an error in your callsign, repeat a few times the part of your call where the error occurred. Example: he says 'G3ZZW 59'. Go back to him with: 'this is G3ZZZ zulu zulu zulu G3ZZZ 59 over'. Normally he will then answer 'G3ZZZ thanks' or something similar. Make sure you have a confirmation of the correction as explained above.
- If the DX station returns with a partial call which does not resemble your call, or if he comes back to another station, then **keep quiet and listen.** If you keep calling it's likely that one of the following scenarios will happen:
  - The DX station notices you are not following his instructions and you end up on his *black list*, which means you will not be able work him in the next few (many) minutes because of your *bad behaviour* (the DX station would love to work, but does not appreciate being willingly or unwillingly disturbed by you!).
  - Alternatively the DX station may call you and give you a RS '00' report, by which you have been identified as an *offender* and displayed as such.
- If you keep calling out of turn while the DX station is trying to work another station, you are only causing QRM to that station, and you are slowing down the whole process. Not only will that station suffer from it, but eventually you will as well.
- If the DX station calls '1ABC **only**, you are 59, over', this means he has a problem with undisciplined stations calling out of turn.
- Listen carefully to see if the DX station is not calling for particular geographic areas. 'Japan only' means that all stations from other countries but Japan should refrain from calling. **Keep quiet**, unless you are located in Japan.
- Perhaps he is calling *by numbers* (also sometimes called *by call areas*): 'listening for sixes only' means that only stations having a number 6 in their call are invited to call him. Others: **wait, keep quiet**.
- If you are a low power station (QRP), do not call as 'G3ZZZ stroke QRP'. The DX station has problems enough with the pileup, he does not need the extra ballast from the 'stroke QRP'. Don't forget, in many countries using 'stroke QRP' as a call suffix, is illegal.
- When the DX station comes back to you with a report ('G3ZZZ 59'), return with a short confirmation and report 'thanks, 59 also' (or '59 thanks'), and nothing else. There are many other stations waiting to make a QSO.

III.1.5. Simplex pileup in CW

- The general rules and procedures as explained above, obviously also apply to contacts on CW.
- Never call with 'DE DL9ZZZ'. The word *DE* is superfluous and contains no information. The letters *DE* could also be the first 2 letters of a German callsign and lead to confusion.
- Never end your call with a 'K' at the end (K as invitation to send). This can cause confusion. If you send 'K' after your call (maybe after too short a space), the DX station may think that it is the last letter of your callsign. So: no 'K'.
- Listen to the pileup to determine the sending speed you should use. Does the DX station work the slower or the faster stations? Don't show off by sending too fast, like we sometimes hear. This is bound to be counter productive.

- In CW, 'KN' at the end of a transmission means 'over to you only'. When the DX station sends: '…W1Z? KN' (or 'W1Z KN'), he wants to hear only the station with the callsign containing the characters *W1Z*. All others should stand by.
- If the DX station sends 'CQ NA' or 'QRZ NA', it means that he is looking for stations from North America only (NA = North America, SA = South America, AF = Africa, AS = Asia, PAC = Oceania /Pacific, EU = Europe, JA = Japan, USA = United States of America). So, follow the instructions.

III.1.6. Split frequency pileup in phone

If too many stations are calling on the DX station's frequency, the DX station will have to switch to **split frequency** operating, which will allow him to increase his QSO rate. How is this done? What do you need to know and to do, to be among the first ones to work the DX station in a split frequency pileup?

- Start by listening. Next, listen more!
- There are a few things you should know before you start calling:
  - Where is he listening? Is he listening on just one frequency or on a frequency range?
  - Is he listening for stations at random?
  - … or for certain areas of the world?
  - … or by numbers (the figure in your callsign)?
  - How does the DX station indicate where he is listening? He says e.g. 'up', 'down', 'up 5', 'down 10', 'listening between 200 and 210' etc.
- The better DX operator will indicate his listening frequency **after each QSO**; don't however expect this is always being done. If the pileup is very big, the DX station operator may think he can increase his QSO rate (gain 1 second every contact) by *not* telling the crowd after each QSO where he is listening. Not good practice though and it makes the people who just arrived on the scene, nervous. They have heard the DX station making a number of contacts without giving its call.
- Make sure you have well understood the listening range as specified.
- If he indicated a **specific area** he is listening for in which you are not located, relax, get yourself a drink, and listen!
- Maybe he is listening **by numbers**. If the number he specified does not match the number in your callsign, sit back and keep cool…
- If he specifies 'listening 14200 to 14225', it is almost like playing roulette unless you know where exactly he is listening. Therefore, keep listening and try finding out the exact frequency where the stations operate that he works. Most DX stations move slowly up and down in that range. Some just jump around like a kangaroo. In general, you will have the best chance to catch the DX station by calling slightly above or under the frequency where he worked his last station.
- Try to know as much as you can about the DX station's way of operating. Is he the kangaroo type or the slow moving type? The more you know about his *modus operandi*, the better your chances are to catch him quickly.
- Make sure you get the **rhythm** and the **pattern** of the DX station. A good DX station operator uses a fixed QSO pattern. Know the last words he sends before listening (usually either his call or 'thank you' or '5 UP' etc.).
- Before making any transmission, make sure all controls on your radio are set

correctly. Is your transceiver set for split frequency work, and is your transmit frequency set correctly? Double check!

- If you found where he made his last QSO, adapt your strategy to his operating pattern and give your call **just once** and listen.
- If he did not come back to you within 1 or 2 seconds, call again on the same frequency. Repeat this procedure until you hear the DX station coming back to someone (hopefully you!).
- If he comes back to another station, **stop calling** and start looking where that station is transmitting. It's a little bit like a cat and mouse game, only there is one big cat, and many little mice of which you are but one…
- Unfortunately you will always hear stations that keep endlessly throwing in their call even while the DX station is working someone. It often sounds like that's the way the majority of the stations do it. Reality is that, by doing so, these stations cause QRM and make progress much slower than what it could be with a little discipline.
- Operators who indulge in such procedures quickly make a non-enviable reputation for themselves. This procedure is the best guarantee for stations to be in there calling for a long time. It is clearly an example of how not to do it.
- Maybe the DX station operator will identify them as poor operators by replying to these offending perpetual callers and giving them an RS '00' report. Let's hope they understand what that means.

III.1.7. Split (frequency) pileup in CW

- In general the rules and procedures as explained for split operation in phone and for CW simplex remain applicable.
- How does the DX station indicate it is working split? At the end of each contact it will send e.g.: 'UP', 'DWN', 'UP 5' 'DWN 10', 'QSX 3515', 'UP 10/20'. A simple 'UP' or 'DWN' usually means that the DX station will listen 1 to 2 kHz up or down from its transmit frequency.
- It would be ideal to be able to transmit and listen at the same time, which we can approximate by operating **full break-in** (also called **QSK**). In full break-in we can listen between the *DITs* and *DAHs* of our own transmission. This means that we can hear the DX station the same split second he starts transmitting. Not all transmitters (and amplifiers) however, are equipped for QSK. You can also work **semi break-in** (*slower break-in*), in which the equipment switches from transmit to receive and vice versa between words or even letters. The delay time is usually adjustable to suit one's preference. Full break-in is an unmistakable advantage when calling in a split frequency pileup. It can help you avoid from inadvertently transmitting while the DX station is on the air. After all, we want to hear what the DX station is sending, don't we?

III.2. TAIL ENDING

- What is **tail ending**? A tail ender tries to outrun the competition by being *faster than his shadow*. He is listening to the station being worked by the DX station, and a split second before that station turns it over to the DX station, he throws in his call, usually half on top of that station. He is literally *stepping on its tail.*

- Strictly speaking, tail ending is even illegal as you are intentionally transmitting on top of another station, and hence causing interference to that station.
- In many cases it's not only the tail they step on, but more or less the entire beast.
- This operating procedure is not very polite but rather aggressive. The consensus is: don't do it.

THE ENDLESS CALLERS

Yes they exist, and there are many, many of them. They just want to work the new rare one, **whatever means it takes**. They do not have the slightest consideration for other stations. They transmit their call just as a continuous broadcast transmission, and hardly listen at all. Often one can hear the DX station coming back to them, two or three times, but to no avail. They don't hear the DX station because they (almost) never listen, and maybe because they have a typical 'alligator' station. Calling the DX station seems to be their hobby, not working the DX.

All of this would not be so bad and sad if, by this shameful practice, they did not cause a lot of QRM to other stations. What they do is pure and simple jamming.

This endless calling is an **ultimate proof of egoistic behavior**; shame on those who practice it.

III.3. DXPEDITIONS

- Many hams chase DX stations or chase *rare* countries or entities with hardly any ham population or any population at all.
- What counts for a *country* or better an ***entity***, has been established by the DXCC (DX Century Club), the organization which issues the much coveted DXCC award. See www.arrl.org/awards/dxcc/.
- Hams chasing DX try to work (= make a QSO with) a station operating from each one of these entities (almost 340 at present), and preferably on different bands and on different modes. This is the sport called **DXing** or **DX chasing**.
- To make it possible to work the rarest entities, hams organize expeditions to such rare spots. These are called **DXpeditions**. Larger DXpeditions are organized by groups of hams, sometimes comprising a dozen operators which will make the rare country available day and night and sometimes for weeks on end.
- The larger DXpeditions manage to make over 100,000 contacts in just one or 2 weeks! In most multi-operator DXpeditions multiple stations are simultaneously active on several of the amateur radio bands and modes.
- If you want to know about the DXpeditions that are currently active, and about the planned ones and the past ones, check ng3k.com/Misc/adxo.html.
- During DXpeditions it can be very crowded in certain portions of the (HF) ham bands. DXpeditions should always take into account other users of the bands,

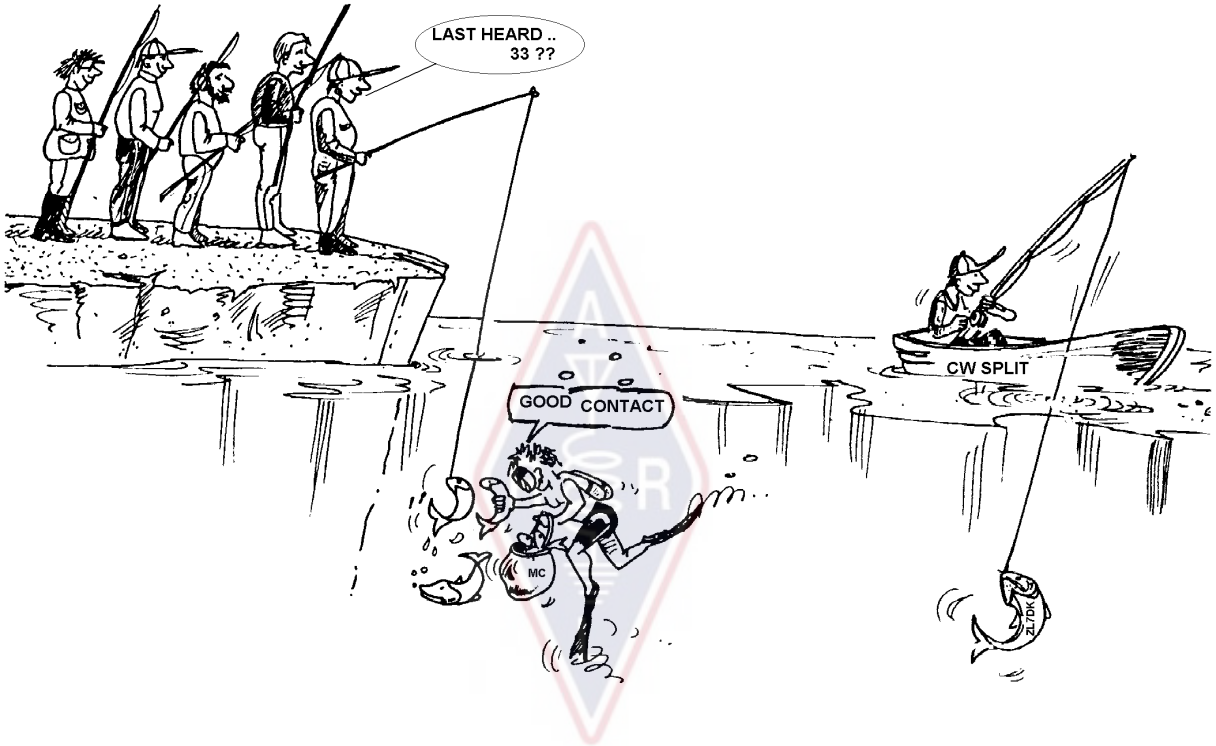
and not invade major parts of the bands for an activity not all hams are involved in.
- Contacts with these DXpeditions are usually as short as contacts during a contest: only the call and a quick report are exchanged.
- Just about all contacts with DXpeditions are made in split mode
- The quality and the expertise of DXpedition operators are often judged by the amount of spectrum they require to work a split pileup.
- When important DXpeditions are active, a number of hams act like if they were called upon to complete a sacred mission to play *frequency cop*. Don't be tempted to become a frequency cop, we have too many of them already (see § III.10).
- Others, mainly frustrated minds, seem to enjoy making deliberate interference to such expeditions. They are simply making **deliberate QRM** (DQRM). If you witness this, do not react, just ignore it, they will go away if they have no audience to interact with. It is sometimes difficult to keep quiet but making comments only makes the chaos worse (see also § III.11). If you are sure you have identified one of these DQRMers, consider making a formal complaint to your licensing authorities.
- If you need any information about a DXpedition, do not ask for it on the DXpedition's frequency. Check the DXpedition's website or one of the *DX bulletins* where you can find all details: QSL address, operating frequencies, operators, and if applicable, the calls of possible *pilot station*(s).
- **Pilot stations** are the public relations managers as well as contact persons for a DXpedition. If you need to know something which you cannot find on the DXpedition's website, send an e-mail to the pilot station. He may be able to help you.
- Never ask on the DXpedition's frequency questions like 'QSL MGR?' or 'PSE SSB' or 'QSY 20M' etc. Better yet, don't ever transmit on their frequency (assuming we're talking split frequency operation)!

III.4. DX NETS

- Before the Internet was introduced to the ham community, a number of *DX Information Nets* were run on different amateur HF bands. Daily broadcasts gave information about recent as well as planned DX activities. For a number of years now, these nets have been replaced by different information systems, available via packet radio and the Internet.
- Besides these valuable DX nets, there is another form of DX net, aimed at *helping* stations to work DX. Working DX on DX nets, is like working DX in the *assisted category* (= with assistance).
- Many DX nets exist mainly to boost the ego of the net control operators.
- Here is how it usually works:
  - A net control station or *Master of Ceremony* calls for stations wanting to work a DX station who's waiting on the net's frequency.
  - In most cases, the MC will request stations to check in with only the last letters of their callsign, which is an illegal way of identifying in most countries. The MC makes a list of those callers. When the list is compiled, he will feed the stations one by one to the DX station. If a QSO is not

succeeding immediately, the MC will be glad to assist (from '…SS station, call again…' up to giving half of the report: '…you have the readability correct, but the signal strength is better than what you said…'). Often the MC is making half of the QSO… Not surprising that we sometimes hear comments like 'make one more guess…'.

- It is obvious that all of this has little to see with the **real sport** of DXing! Both serious DXers as well as experienced DX stations will stay away from such DX nets if at all possible.
- Such DX nets are not the place where you will learn the sport of DXing, neither learn how to improve your station nor your operating capabilities.



III.5. THE USE OF PARTIAL CALLS

- We have touched upon this subject before, and as it is such a bad habit and outspoken proof of poor operating practice, we come back to this subject:
  - In most DX-nets the callers are invited by the *MC* to call with only the last 2 letters of their call. It is ineffective and in addition illegal in most countries (you should always identify with the full callsign as received from the administration).
  - Net control stations use as an argument that they do not want to know the full callsign of the stations calling, so that they would not give it on the air whereby the DX station would copy the call via the control station. Noble thought, but it does not make sense.
  - The *MC* can ask the calling stations to check in correctly, which means by their full callsign. If the DX station at that time already copies the station checking in, the better for him.
  - If later in the procedure the *MC* calls the stations that have checked in, **he**

can call them by the last 2 letters of their call, which is quite legal. The rules say how you have to identify yourself, not how you call another station. Example:

- The MC says: 'stations for ZK1DX, check in please'
- OH9ZZZ gives his (full) call: 'OH9ZZZ'
- If later in the procedure the MC calls OH9ZZZ, he simply says 'station with ZZ at the end of the call, make your call'
- OH9ZZZ now calls the DX station: 'this is OH9ZZZ, oscar hotel nine zulu zulu zulu calling ZK1DX, you are 55 over'
- etc.

It could not be simpler, and every step in this procedure is legal.

- Some have even started using this 2-letter procedure off the DX nets, e.g. in DX pileups.
- In addition to being illegal it is inefficient. Why?
  - Some simple mathematics will tell you: assume your call has 6 characters. If you only send 2 letters, the chance that at least part of your call will be copied is 3 times smaller than if you had given all 6 characters.
  - Your call is unique; two letters from your call are far from unique. This means that this procedure will often lead to confusion (several stations with those 2 letters calling simultaneously).
  - If the DX station copied your two letters (hopefully you're the only one using those 2 letters to call) he will still have to ask for the rest of your call. It is a pure waste of time. If he could copy two letters, there's a good chance he could have copied all 6 characters! All of this takes time, creates confusion and increases the chances of QRM.

Conclusion: never send just a part of your call. Are you ashamed of your call? Always send your full call, **be proud of it**! If, under whatever circumstances, someone asks you to identify by 2 letters of your call, identify by your full call and perhaps tell him you cannot do what he asks because it is illegal.

III.6. DX CLUSTERS

DX Clusters have largely replaced the local and international *DX information nets* of yesteryear.

III.6.1. Main Purpose

- Which DX stations are active *now* and on *which frequency*?
- DX Clusters are part of a global (worldwide) network, spreading *real time* information.
- It's a two-way system:
  - Spotting: entering interesting DX information to be used by others.
  - Using spots: you use DX information that's interesting for you.

III.6.2. Who do you spot?

- Rare DX-stations that are of interest to DX chasers. An example: ***14025 ZK1DX QSX UP5***.
- Do not send spots that have no added value. Do not spot *common* stations,

e.g. all stations from countries where there is plenty of activity such as W, F, G, ON etc., unless there is a good reason for it that makes your spot valuable. You can e.g. spot W6RJ on 160m from Europe, as we don't work W6's every day from Europe on 160m.
- Before spotting a DX station, first check if no one else has just spotted that same call.
- Watch out for typos! Wrong calls can sometimes be found in logs because the operator worked a station without even having heard its callsign, blindly having copied a busted (incorrect) call from the DX Cluster.

III.6.3. Which information is available, how to retrieve it

- **Activity info:** the DX spots. The spots come automatically on your screen in **chronological** order. You can retrieve **spots by band** (e.g. *sh/dx on 20m* gives you the last 10 spots on 20m , *sh/dx 25 on 20m* shows you the last 25 spots on 20m), **by call** (e.g. *sh/dx ZK1DX*, or *sh/dx ZK1DX 20*) or by **combination of band and call** (e.g. *sh/dx ZK1DX 20 on 15m*).
- **WWV** (see en.wikipedia.org/wiki/WWV_(radio_station)**, Solar Flux Index:** common commands are *sh/wwv* and *sh/wcy*.
- **QSL info:** on most DX Clusters you can retrieve QSL info using *SH/QSL cal*. If this function does not exist, type *SH/DX call 25*. Now you get the last 25 spots for that station, and chances are that one of the spots has the QSL info in the commentary field. A third possibility is to type *SH/DX call QSL*. This will list the last 10 spots for that station where the word *QSL* or *via* appears in the commentary field.
  - Some DX clusters may not have all of these commands, in which case you can find the QSL info via an Internet search engine.
  - It is not good practice to spot the station for which you need the QSL info by typing *QSL info please* in the commentary field. The purpose of this field is to provide additional useful information regarding the DX station. It is not the place to ask questions.
  - Depending on the DX Cluster's software, the abovementioned commands may vary somewhat. See your DX Cluster's help file.

III.6.4. A spot appears: a new country for you. What now?

- Do not start calling the DX station blindly.
- Make sure you copy the station well enough, verify if the spotted callsign is correct.
- Make sure you have heard the DX station's instructions before calling (his listening frequency, is he working *everybody* or working by numbers or by geographical areas?).
- Apply the guidelines as explained in § III.1. (Pileups). Good luck!

III.6.5. Things not to do on a DX Cluster

- **Self spotting**
  - What's that? It's a personal advertisement to the whole world, saying: *Here I am, on this frequency, please call me*.
  - It needs no explanation that this is just not done in Ham Radio. If you want to make QSOs, call CQ or reply to stations calling CQ.

- Self spotting leads to disqualification in contests.

- **Disguised self spotting**
  - An example: you work a nice DX station that came back to your CQ. When you finish your QSO you spot the call of the DX station, which was there but went off the frequency after finishing the contact. This spot has zero added value for the DX community, as the DX station is gone, but at the same time you attract a bunch of DXers to your frequency, hoping that this will help you work some other DX stations. This practice makes DXers nervous.

- **Bragging**
  - A spot is not for telling the world how great you are: don't spot a DX station (that's been spotted several times anyhow) with a remark: *I finally did it…*. In such a case you are not announcing the DX station, you're just bragging and telling the world how great you are… Modesty is a nice virtue.

- **Spotting a friend**
  - A good friend of yours is calling CQ repeatedly, without reply. You want to give him a little push and you spot him, though he is not at all a DX station. Don't do it. Neither your friend nor you will gain respect in the eyes of the ham community by doing so.

- **Asking a friend to spot you**
  - Is self spotting, using a cover up. Self spotting is not done, so do not you ask your buddy to spot you.

- **Being a cheerleader:**
  - Those who continuously spot their favorite contest station during a contest. It's like the supporters pushing bike racers during a race in the mountains. It isn't fair and it's unsportsmanlike.

- **Send a spot which actually is a private message**
  - We need to realize that each spot, each message on a DX Cluster is sent to many thousand of hams all around the world. DX Clusters have been connected through the internet for some years and your local DX Cluster is no longer local but part of a global network.
  - Unfortunately, some spots are private messages, like in this example: HA7xx sends a spot: *VK3IO on 1827*, with as comment *QRV???*, which obviously is not a spot but a private message (typed in the commentary field).
  - Another example: *UA0xxx spots ZL2yyy on 3.505 kHz* and adds *ur 339, my RST 449? Pse confirm*. This guy is making a fool of himself. His reputation amongst DXers is destroyed!

- **Using the DX Clusters as a worldwide chat channel**
  - With the **TALK** function you can send individual messages to another ham on your local DX Cluster. Some DX Clusters have a similar talk function where you can chat privately to a user on another DX Cluster, of course provided these clusters are linked (by e.g. a radio link or internet).
  - The **Announce Full** (**To All**) function is a totally different story. Any

message sent using this function will be sent to the users of all world wide linked clusters, and that may be many thousands at any given time. Be **very careful** when using this function. Most *To All* announcements are actually intended for one particular person, where 9,999 others are forced to read a message which is of no value to them. Example: a To All message from ON7xxx reads like *ON4xx, good morning Frans*. Another example, To All de DF0xx: *wir warten auf K3714*. Whatever that means. And there are, unfortunately, thousands more similar examples.

Do not ever use the *Announce Full* function as a chat channel. Also, never use this function to settle an argument or to insult someone. The world is watching you!

Only send messages that are of interest to a vast majority of the DXers. Example: you could announce that the DXpedition has just moved band, or frequency, or that they will be on such and such a frequency at such and such a time. Etc.

The general rule is: *To All* messages should indeed be of interest *to all*. If a message is not of interest to all (or a vast majority of them), don't send it via the *To All* function.

- **Using someone else's callsign on the DX Cluster**
  It appears that some disturbed minds check into a DX Cluster with other people's callsign, and do totally unacceptable things. This is even worse than anonymous transmissions, as in addition the call of an ignorant ham is being defamed.
  Never react on the DX Cluster if you are confronted with a similar situation.

III.7. DX WINDOWS

- The IARU Band Plan is a worldwide accepted *gentlemen's agreement* that 99 % of the radio amateurs adhere to.
- This Band Plan lists a couple of formal DX windows, where it has been agreed upon to give full priority to long distance work (DX contacts).

III.7.1. DX windows on the HF bands

- Presently there are three such windows in **IARU R1** (Europe, Africa and Middle East): **3.500-3.510 kHz** (CW), **3.775-3.800 kHz** (SSB) and **14.190-14.200** KHz (SSB). In **IARU R2** (North and South America) we count 6 windows: **1.830-1.840** kHz (CW), **1.840-1.850 kHz** (SSB), **3.500-3.510 kHz** (CW), **3.775-3.800 kHz** (SSB), **7.000-7.025 kHz** (CW), **7.175-7.200 kHz** (SSB) and **14.000–14.025 kHz** (CW) .
- The DX windows on 80m: in the middle of the day these frequencies can be used for *local* traffic, as there is no long distance propagation at that time. But we should be aware that even shortly after noon, local contacts in the DX windows of this band can cause problems to stations that are 1000 to 2000 km in the direction of the *terminator* (the line that separates the dark hemisphere from the lit hemisphere). Example: 13:00 UTC in Belgium in midwinter. It is 3 hours before sunset. At this time it is impossible to work DX from Belgium. But our signals can be heard with quite good strength in Scandinavia, only 1000 to

2000 km away, where sunset is several hours earlier. Although we do not hear DX stations at that time, we can very well cause QRM to other stations that are much closer to sunset. Conclusion: stay out of these windows at all times, unless you are trying to work DX yourself.

- When DXpeditions are active, these stations have full priority in using the abovementioned 20m DX window. Under those circumstances all other stations should clear these frequencies and do that in the true spirit of the IARU's gentlemen's agreement. This 20m DXpedition window was created in 2005, as a result of a continuous problem caused by an IT9-station.
- In addition to these *formal* windows, there are a number of *de facto* DX windows:
  - In SSB: 28.490-28.500, 21.290-21.300, 18.145, 14.190-14.200, 7.045 and 1.845 kHz
  - In CW: the first 5 kHz of each band, and also: 28.020-28.025, 24.895, 21.020-21.025, 18.075, 14.020-14.030 and 1.830-1.835 kHz
  - In RTTY: ± 28.080, ±21.080 and ± 14.080 kHz

  Avoid making local contacts in those windows. These are the frequency ranges where you can look for interesting DX stations.

III.7.2.c On VHF-UHF See the official IARU Band Plan: http://www.iaru.org/bandplans.html

III.8. SPECIFIC OPERATIONAL PROCEDURES FOR VHF AND HIGHER

- These are based on the same principles that apply to the HF bands.
- For QSOs via tropospheric propagation (local, or via temperature inversion) on the 50, 144 and 430 MHz bands, the procedures are exactly the same as on HF. The only difference is that often calling frequencies are used to initiate a contact. Once a contact is established, the stations will move to another frequency.
- QTH-locator: on VHF and higher, station locations are usually specified by using the QTH-locator, also called Maidenhead locator. The QTH-locator is a set of simplified coordinates (e.g. JO11) which allows the user to quickly judge the direction and the distance to the station he is working.
- There are specific operational procedures applicable to some very specific modes, mostly used on VHF and higher, such as:
  - Contacts via satellite.
  - EME QSOs (reflection via the moon).
  - Meteor scatter QSOs.
  - Aurora QSOs: reflection near the poles during Aurora.
  - ATV (wideband amateur television).
- It is outside the scope of this manual to enter into detail on these subjects. In all cases, operational behaviour remains based on the principles as explained in § I.2.

III.9. CONFLICT SITUATIONS

As explained in § I.2, the fact that we all (we're several hundred thousand hams in the world) *play* our hobby on one and the same field, the ether, will inevitably sometimes lead to conflicts. How do we handle these, that is the question!
Our behaviour on the bands should be based on **common sense, good manners** and **mutual respect**.

- Rule # 1: **never do or say what you would not want your best friend nor anyone else in the world to know about.**
- A problem is that radio transmissions can be made **anonymously.** A person making unidentified transmissions with malicious intentions is not worth being a radio amateur.
- Never ever contemplate **jamming** the transmissions from another station. As jamming can be done anonymously, it is the utmost expression of cowardliness.
- There simply is no excuse for such behavior, even if you think that the station deserves to be jammed.
- So, maybe there is a situation which in your opinion needs to be corrected? Perhaps rightfully so, but think twice what will be the **added value** to our hobby, to YOUR hobby, to your reputation, before you start doing or saying anything.
- Don't start **discussions** on the air. Chances are that others will join in and in no time what maybe started as a more or less friendly discussion, may degenerate. Keep personal conflicts off the air. Settle your arguments on the telephone, the Internet or in person.

III.10. COPS (FREQUENCY POLICE)

- Cops are self appointed would-be *frequency policemen* who think they need to correct other hams making an error, on the air and on the spot.
- Sometimes it is indeed necessary that a continuous *offender* (e.g. someone keeps calling on the transmit frequency of a DX station working split) gets told that he is causing a problem. But there are ways of telling…
- Time after time we note that the intervening cops cause a lot more havoc than the station they want to correct.

III.10.1. Types of 'cops'

- Most *cops* have good intentions and are not using foul language. They remain polite and are often successful in their attempt to keep the frequency of a DX station clear.
- Some *cops* also have good intentions but by using bad language and manners they don't achieve their goal to clear a frequency. These *cops* create chaos instead of calm.
- A third category consists of those using foul language with the objective of creating chaos. Their bad language and manners attract comments from colleague *cops*, with a resulting total chaos!

Do not react if you hear one of those would-be cops in action. Keep your distance and ignore them completely. This is the only way to make them stop.

III.10.2. What makes the cops appear?

- *Cops* mostly appear on a rare DX station/DXpedition's frequency, usually when this station is working in split mode.
- The trigger for their appearance is when an operator forgets to activate the split function on his transceiver and starts calling the DX station on its transmit frequency. This is the time for *cops* to start shooting/shouting.

III.10.3. The good sinners …

- Quite a number of hams just don't know the proper way of operating under all possible circumstances. Not that they don't want to be good operators, but they just don't know how. They have to learn the trade by falling down and getting up. The reason is they were never taught. These are the ***good sinners***.
- ***Errare humanum est*** (*to err is human*): even so called experts make mistakes. No single human being is perfect. Everyone has on occasion transmitted on the wrong VFO (which means on the transmit frequency of a DX station working split). Maybe because we did not pay enough attention. Maybe we were tired or distracted; after all, we are only human.
- The first thing to consider in a situation where someone's error **needs** to be *corrected* is **how to pass the message**.
- When one gets called to order by a cop shouting 'up you idiot', it is sometimes difficult to refrain from answering on the spot 'have you never made a mistake, you arrogant cop?'.
- Don't however react in such a case, it will always be counterproductive.
- This is how chaos usually sets in.

III.10.4. … and the bad sinners

- Some hams however seem to delight in using very poor operating habits. In this case ***Perseverare diabolicum*** (*to persist is devilish*) applies.
- There appear to be more and more *disturbed characters* that literally enjoy making life difficult for the well behaved operators. These are the sorts that try to disturb DXers with all means at their disposal. In some cases these are frustrated hams who, due to lack of knowledge and wisdom, are not successful in contacting the DX station, and who vent their frustration on their more successful colleagues.
- Sometimes we witness the most blatant use of vulgarity and obscenities from these characters.
- All they want is to make others react so that chaos erupts on the frequency.
- Some good advice: **never react** when you witness such an act. If nobody reacts, these characters will go away by lack of an audience (see also § III.11). If you are sure you have positively identified a station making this kind of **deliberate QRM**, consider making a formal complaint to your licensing authorities.
- Do not react either via the DX Cluster. Rest assured they are watching the DX Clusters as well.

III.10.5. Do you really want to be another cop?

- When you hear someone making a big or repetitive mistake, remember that you too have made errors in the past, haven't you? Be tolerant and forgiving!

- If you really need to say something (to correct a repetitive error), say it in a friendly and positive way, without insulting or sounding patronizing. If ON9XYZ by error repeatedly transmits on the wrong VFO, say '9xyz up please', not 'up you idiot'. The insult brings no added value to the message. It only tells us something about the person making the insult.
- Realize that your intervention may cause more interference than the actual error you try to correct!
- Before playing cop, think twice in which way your act will have a positive added value. If you still think it needs to be done, twist your tongue three times before going ahead.
- Always be polite and constructive.
- If you need to tell someone he's transmitting on the wrong VFO, always add a part of that station's call. How else can he know that your message is addressed to him? Say '9XYZ up please' not just 'up please' nor 'up up up up'.
- If you happen to be the 9xyz station, do not feel too embarrassed, *errare* only *humanum est*, and your apology will just cause more QRM.
- Don't forget that every cop, by acting as a cop, is doing something illegal: have you heard many frequency cops identifying as required?
- Another thought: one good cop can be a blessing, two cops are a crowd.

III.10.6. How to behave in the middle of a cop parade?

Being a DXer you will quickly grasp that you accomplish more by not reacting to cops at all. Try to swing something negative into something positive. Keep on **listening** (here's the magic word again) through the tumult to the DX station and in many cases you will be able to log the DX station while the cops are having a *jolly good time*.

III.11. TIPS FOR DX STATIONS AND DXPEDITION OPERATORS

Maybe sooner or later you will be operating at the other side of a pileup. Maybe you will be operator on a DXpedition, a dream of many hams. For the serious operator there are a number of guidelines and procedures to be applied as well, if he wants to be a successful operator. Here are a few tips:

- Give your callsign after **every** QSO. If you have a very long call (e.g. SV9/G3ZZZ/P), give it at least every few QSOs.
- If you work simplex and you cannot sort out the calls well enough (because too many stations call simultaneously on the same frequency), switch to split frequency mode and spread out the callers. Don't forget that, especially on the low bands where signals from far away DX stations can be very weak, you will be totally covered by the calling stations which are easily 50 dB stronger than you. For a rare DX station *split* is the way to operate.
- Before changing to split mode, check if the frequencies you want to use for listening are clear
- If you work split, mention it **after each QSO**. For example in CW: 'UP 5, UP5/10, QSX 1820' etc. In SSB: 'listening 5 up, listening 5 to 10 up, listening on 14237, up 5, down 12', etc.
- Do **not** give the split indication 'every now and then'. It may make the pile where you listen a little less dense, but inevitably creates havoc on your

transmit frequency and will make the split frequency band much wider than required. This is an unacceptable practice from all point of views.

- In CW split, listen **at least 2 kHz** above (or below) your transmit frequency, to avoid interference to your signal from key clicks generated by callers. A split of only 1 kHz, as is done regularly, is not enough.
- In SSB, this should be **at least 5, preferably 10 kHz**. Some signals of calling stations can be very wide and cause a lot of splatter on your transmit frequency.
- If, as a DX station, you operate split in the DX window of 80m (in Region 1: 3,5 – 3,51 MHz on CW or 3,775 – 3,8 MHz on phone), **listen for the pileup outside the DX window**. If you transmit e.g. on 3,795, listen below 3,775 MHz for the pileup (in CW above 3,51 MHz).
- Keep your listening window as narrow as possible to avoid interference to other band users.
- If in SSB you copied only part of a callsign, reply with that partial call plus a report, e.g. 'yankee oscar 59'. Do **not** say 'yankee oscar, again please'. Guaranteed this will attract a whole range of yankee oscars! If you have added a 59 report, you already made half of the QSO and there will be fewer disorderly callers.
- In CW, in a similar case, never send a question mark if you copied a partial call (e.g. 3TA). A question mark will trigger half of the pileup to start calling you. Send '3TA 599', and **not**: '?3TA 599'. Never send question marks in a pileup situation.
  - The following applies to all modes: if at first you copied only a partial call, always repeat the full call once you have it, so the station that called you is sure he worked you and can put you in his log. Example: assume you first copied a partial: '3TA'. Send '3TA 599' (in phone say '3TA 59'). He confirms: 'TU DE OH OH3TA 599' (in phone: 'oscar hotel, oscar hotel three tango alpha you're 59 QSL?'). If you now confirm with 'QSL TU' (in phone: 'QSL thank you'), there is no way OH3TA can tell you worked him. Therefore, confirm with: 'OH3TA TU' (in phone: 'OH3TA thanks').
- Once you returned to a partial call with a report, stick to that station, and do not let him be overpowered by other callers. You're the boss on the frequency, show it. You decide who gets in the log, no one else. The pileup can be quite undisciplined, but often this is due to a lack of authority from the operator of the DX station. If the crowd notices that you stick to the original partial call, and that their out of turn calling is to no avail, they will eventually give up, and show more discipline.
- If you give up on the original partial call and just pick up one of the loud undisciplined callers, you admit the wild callers are in charge of the frequency. Now you're in trouble. In many cases, chaos is a result of the DX operator not showing authority or not living by his own rules.
- If the partial call you originally came back to disappeared, do not just pick up the call of one of the strong undisciplined callers who's been giving you a hard time the last several minutes. Just call a CQ again and listen a few kHz higher or lower. **Never give the impression you are now calling one of the undisciplined callers**. Show them that their undisciplined calling was useless.

- You have returned for a particular station in the pileup (e.g. JA1ZZZ) and you have put him in the log. However he keeps calling you again, obviously because he did not hear you give him his report. Do **not** go back to him with 'JA1ZZ you are in the log' (on phone) or 'JA1ZZZ QSL' (CW) but **call him again and give his report again**. He obviously wants to hear his report!
- Always follow a **standard pattern** in your transmissions. Example (you are ZK1DX):

  ZK1DX 5 to 10 up → you hear ON4XYZ calling
  ON4XYZ 59 → you give his report
  QSL ZK1DX 5 to 10 up → you confirm, identify and call again
- If you keep following that same pattern, the pileup will know that when you say '5 to 10 up', you are listening again for new callers. Always maintain this same pattern, the same speed, the **same rhythm**. This way everyone will know exactly when to call. Should be like clockwork.
- If the pileup remains undisciplined, do not get too excited about it. If the situation does not improve, just move to another mode or band, but let the pileup know.
- Always stay cool, don't start insulting the pileup. All you can and must do is to firmly show the pileup that you are in charge, and that you set the rules. It is important that you emanate authority.
- Do not work so-called two-letter calls. If you hear such stations, tell them you want to hear 'full calls only'.
- If in split mode it appears that many of the calling stations are not copying you well, it is likely that your transmitting frequency suffers from interference. If this situation persists, in SSB try changing your transmit frequency 5 kHz, and tell the pileup about your move. In CW, moving 0.5 kHz will usually suffice.
- On CW, 40 WPM is about the maximum speed to be used during a smoothly ongoing pileup. On the lower HF bands (40-160m) it's better to use a little lower sending speed (20-30 WPM, depending on circumstances).
- Always keep the pileup abreast of your plans. When you go QRT, tell them. When you need a pit stop, tell them: 'QRX 5' ('QRX 5 minutes', 'standby'). If you move to another band, inform the crowd.
- If you want to keep the pileup calm and more or less disciplined, and keep your transmit frequency clear, the most effective way of doing so is to keep the callers happy. Let them know what you are doing. Know that they all (with one or two exceptions) want to work you. You are hot!
- The DX station operator sometimes works by numbers or call areas. This means that he will only reply to stations having the number he specified in their prefix. Statistically the pileup should be 10 times thinner!
- Avoid as much as possible working by numbers, it's not a very good system.
- If you want to apply this method, apply the following rules:
  - Once you started working by numbers, go through all numbers at least once. If you go QRT in the middle of a sequence, or start working random numbers all of a sudden in the middle of a numbering sequence, you are going to create commotion.
  - Never forget, when you work by numbers that 90% of the DXers are idling, biting their fingernails! They keep a close eye on you and carefully count

how many stations you work of each number, and you can be sure some operators will lose control if you do not soon reach *their* number.
  - Always start a sequence with 0, and move up in numbers one by one. No frills. Keep it simple.
  - Do not specify numbers at random: first 0's, then 5's, then 8's, then 1's etc… It will drive the pileup mad. If you follow a logical sequence, the pileup can more or less predict when it will be their turn. A random system will make them utterly nervous.
  - Work maximum 10 stations of each number. Make sure you work approximately the same total of stations per number. If you manage to work 5 stations a minute, it will still take you 20 minutes to complete the circle. This means some stations will have to wait and sit idle for almost 20 minutes, which is a long time. On average the waiting time is 10 minutes. Don't forget propagation conditions can change a lot in 20 or even 10 minutes!
  - Always tell the pileup how many stations you will work from each number and repeat that information every time you increment the number in the callsign.
- The method of calling by numbers is seldom used on CW.
- A better technique to make the pileup a little thinner is to work by continents or geographical areas. This also gives a better chance to remote regions of the world, where signals are often weak and openings shorter.
- In this case you will specify a continent, which means you insist that only stations from that area should call you. Example: if you want to work only North American stations, call 'CQ North America ONLY' or on CW: 'CQ NA'.
- Use this technique primarily to reach those areas of the world that have poor propagation or short openings to you.
- If you use this technique because the pileup is too dense, rotate quickly between the continents or areas. A good rule of thumb is that one should not stay with the same area for longer than 15 to max. 30 minutes.
- Inform the pileup of your plans, tell them exactly how you will rotate between areas, and follow your planning.
- Switch back to working all areas/continents as soon as conditions permit.
- Both abovementioned techniques should be avoided as much as possible, with one exception, where you look for difficult to reach areas.
- The main problem with these selective methods is that a large majority of hams is sitting idle, and getting nervous. Nervous DXers can easily change into aggressive cops. If you go QRT or change bands just before their number was supposed to come up, rest assured you will be called names on your transmit frequency.
- We have witnessed some DX operators trying to work by country. This must be avoided at all times for obvious reasons: now you have set 99% of the DXers wanting to work you, *on hold*. This way of operating guarantees chaos in no time.
- Watch out when using a preferential treatment for your friends or for stations from your home country. Do it very discretely and make sure it happens *invisibly.* Better yet, don't do it.
- So far we have listed a number of issues, all relating to operating procedures,

aiming at making chasing DX more enjoyable for the DX chasers and the DXpeditioners alike. It is evident that by education and training both groups can improve their operating and achieve a win-win situation for both: a better and more enjoyable DXing world.

- At one time or another almost all of us have been confronted with a situation where deliberate QRMers are out to destroy the fun enjoyed by thousands of DX chasers. They QRM the DX's transmit frequency either using no call or calls they 'borrow' for their unethical behavior. This issue is indeed an **ethical issue** (see § I.2.5), an issue of good and bad, and not an issue related to operating procedures. To a large extent this kind of QRM will not be changed by education and training.
- This D(eliberate)QRM is caused by a small group of social hooligans missing any degree of moral standards. Their acts are merely the expression of a steadily growing degree of selfishness we –unfortunately- seem to find nowadays in many layers of society.
- If you suffer from such DQRM, move frequency slightly, e.g. 500 Hz in CW, just sending your call followed by a string of DITS while slowly QSYing so the pileup understands what you are doing or, on phone, e.g. 5 kHz up or down after having announced your QSY. Don't mention the reason.
- Never acknowledge you are suffering from DQRM. The small numbers of individuals causing DQRM will most frequently stop acting if they have no audience, in other words if no one reacts to their provocation. Always ignore them; never quit.

LEGALLY BINDING?

Are all the procedures as outlined in this document legally binding? Most of them are not. A few examples: in most countries one should identify every 5 (in some 10) minutes. This rule exists for the monitoring stations and control authorities to be able to identify transmissions. These 5 minutes are a legal minimum, but good practice and sound customs as well as search for efficiency and good manners, in one word 'correct operating practice' tells us to also identify at each QSO, especially if these are short contacts as e.g. during a contest or when working a pileup. These operating procedures must make it possible for the entire amateur radio community to be able to enjoy the hobby in best understanding.

A similar example concerns the IARU Band Plan which has no binding legal character in most countries, but clearly serves at making living together on the crowded bands more enjoyable.

Neglecting to apply the operating procedures as outlined in this document will probably not send you to jail, but it will certainly result in inferior operating practice from your side.

Attachment 1: International Spelling and Phonetic Alphabet

Letter	Phonetic word	Pronunciation	Letter	Phonetic word	Pronunciation
A	Alpha	**al** fah	N	November	no **vemm** ber
B	Bravo	**bra** vo	O	Oscar	**oss** kar
C	Charlie	**tchar** li	P	Papa	pah **pah**
D	Delta	**del** tha	Q	Quebec	kwe **bek**
E	Echo	**ek** o	R	Romeo	**ro** me o
F	Foxtrot	**fox** trott	S	Sierra	si **er** rah
G	Golf	golf	T	Tango	**tang** go
H	Hotel	ho **tell**	U	Uniform	**you** ni form
I	India	**in** di ah	V	Victor	**vik** tor
J	Juliette	**djou** li **ett**	W	Whiskey	**ouiss** ki
K	Kilo	**ki** lo	X	X-ray	**ekss** re
L	Lima	**li** mah	Y	Yankee	**yang** ki
M	Mike	**ma** ik	Z	Zulu	**zou** lou

Attachment 2: The Q Code

CODE	QUESTION	ANSWER OR MESSAGE
QRG	What is the exact frequency?	The exact frequency is …
QRK	What is the readability of my signals?	The readability of your signals is: 1: bad, 2: Fairly bad, 3: Reasonably good, 4: Good, 5: Excellent.
QRL	Are you busy? Is the frequency in use?	I am busy. The frequency is in use.
QRM	Are you interfered with?	I am interfered with. 1: I am not at all interfered with, 2: Slightly, 3: Moderately, 4: Strongly, 5: Very strongly.
QRN	Are you bothered by atmospherics?	I am bothered by atmospherics. 1, Not at all, 2. Slightly, 3. Moderately, 4. Strongly, 5. Very strongly.
QRO	Should I increase power?	Increase your power.
QRP	Should I decrease my power?	Decrease your power.
QRS	Should I decrease my sending speed?	Decrease your sending speed.
QRT	Should I stop my transmission?	Stop your transmission.
QRU	Do you have anything for me?	I have nothing for you.
QRV	Are you ready?	I am ready.
QRX	When will you call me back?	I will call you back at … Also: wait, standby
QRZ	Who was calling me?	You are called by …
QSA	What is the strength of my signals?	The strength of your signals is: 1. Bad, 2. fairly bad, 3. Reasonably good, 4. Good, 5. Excellent.
QSB	Is my signal fading?	Your signal is fading.
QSL	Can you confirm reception?	I confirm reception.
QSO	Can you make contact with … (me)?	I can make contact with … (you).
QSX	Can you listen on …?	Listen on …
QSY	Shall I start transmitting on another frequency?	Start transmitting on … Also: change frequency (to …)
QTC	Do you have a message for me?	I have a message for you.
QTH	What is your location (latitude and longitude or by name of the location)?	My location is … latitude and … longitude or : my location is …
QTR	What is the exact time?	The exact time is …

THE AUTHORS:

John **ON4UN** was introduced to the wonderful world of amateur radio by his uncle Gaston ON4GV. John was merely 10 years old. Ten years later he obtained the call ON4UN. John's interest in technology and science led him to become an engineer and his entire professional career was spent in the telecom world. All along he remained active on the bands, which has resulted in nearly half a million contacts in his logs. In 1962, 1 year after he received his callsign, he took part in his first contest, the UBA CW contest, which he won. This was the beginning of a near 50 year long amateur radio career in which contesting and DXing especially on the lower HF bands have played a major role. On 80 meters John has the highest number of DXCC countries confirmed worldwide (he is holder of the DXCC 80m award #1 with over 355 countries confirmed) and on 160m he has the highest country total outside the US with over 300 countries confirmed. John also was the first station world wide to obtain the prestigious 5B-WAZ award.

In 1996, ON4UN represented Belgium at WRTC (World Radio Team Championship) in San Francisco together with his friend Harry ON9CIB. WRTC is commonly called *the Olympic Games of Radio Contesting*.

A highlight in John's amateur radio career was undoubtedly his induction into the *CQ Contest Hall of Fame* in 1997 and into the *CQ DX Hall of Fame* in 2008, honours which until then had been bestowed upon only a handful of non-American hams. John wrote a number of technical books concerning our hobby, most of which are published by the ARRL (the American IARU Society). These covered mainly antennas, propagation and operational aspects concerning the lower HF bands. He also wrote technical software on the subject of antennae, including mechanical design of antennas and towers. Together with Rik ON7YD, he is the co-author of the UBA handbook for the HAREC-license. Already in 1963, as a very young ham, he got involved in Amateur Radio society affairs and became HF Manager for the UBA for a short period. More recently John served as President of the UBA between 1998 and 2007.

John combined his experience and expertise with that of his friend Mark ON4WW, to write this unique handbook *Ethics and Operational Procedures for the Radio Amateur*. A trigger to write this book was the enormous success of ON4WW's article *Operating Practice*, which was incorporated in the UBA HAREC handbook. *Operating Practice* is available in more than 15 languages on Mark's website, and has been published worldwide in a large number of ham radio magazines.

Mark **ON4WW** too, was barely 10 years young when he was bitten by the radio bug. His initial call in 1988 was ON4AMT, which he traded for ON4WW a few years later. Right from the start Mark was particularly interested in contesting, which may be one of the reasons for his special interest in correct operating procedures on the bands. In 1991 he met ON4UN and after some visits to John's place he quickly became a CW buff and in addition a supporter of the more difficult HF bands, 80 and 160m. In the mid-nineties, Mark was one of the key operators at the OTxT contest station of the local UBA club TLS, a contest station which was located at ON4UN's place. In that period this station won world wide first place (multi-single) three times as well as first places for Europe in several other CQWW contests.

In 1995 Mark joined the United Nations and went on a mission to Rwanda. In the following years he was sent on UN missions to several other African countries and each time he was active on the bands and especially on 160m and 80m (9X4WW, S07WW, EL2WW etc.). Later he showed up from Pakistan (AP2ARS) and Afghanistan (YA5T) as well as from Iraq (YI/ON4WW). Other calls Mark used in that period were JY8WW, J28WW and 9K2/ON4WW. Mark's last mission for the UN was in Gambia (C5WW) in 2003.

In 2000 Mark realized one of his dreams, going on a major DXpedition. He was part of the record setting FO0AAA expedition to Clipperton Island in the Pacific, where the crew made 75,000 QSOs in just 6 days. In that same year he was also part of the A52A DXpedition to Bhutan. Still in that same year he represented Belgium, together with Peter ON6TT, at the WRTC in Slovenia where they scored first world wide in the SSB category. Two years later, in 2002, the same team represented our country again at WRTC in Finland.

Over the years Mark has gained a tremendous amount of operating experience. Specifically he has operated for long periods at both ends of the pileups. He has witnessed a lot of operating practice that was and still is today capable of vast improvement. Hence the publication of his article *Operating Practice*, and now his contribution to this more elaborate publication.

_____